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CONTENTS.

EDITORIAL:
- Central Stations in Small Communities..... 141
- Electrification of the Southern Pacific..... 142
- A Hydroelectric Problem..... 142
- Ohio Electric Light Association's Convention..... 143

National Electrical Contractors' Association's Annual Convention—Report of the Proceedings..... 144
The Philadelphia Electrical Exposition..... 144
Southern Pacific Electrification..... 144
The Tariff and Its Relation to the Electrical Industry..... 145
Electric Power in the New England Mills..... 147
California Electrical Supply Companies Unite..... 147
Ohio Electric Light Association's Annual Convention—Complete Report of the Proceedings..... 148
An Accident and a Quick Recovery..... 154
The Manufacture of Artificial Nitrates from Air in Norway..... 155
Central Stations in Towns of Less Than 4,000 Inhabitants..... 160
Colorado Electric Light, Power and Railway Association..... 163
The Faraday Society..... 164
Discriminates Between Bulk and Retail Service..... 165
Chicago Electric Club..... 166
Annual Convention of the American Society of Civil Engineers..... 166
Electrification Shows in Germany..... 166
Briquette Making..... 166
The Preservation of Poles..... 167
Rockingham Power Company Sold..... 168
New Copyright Law..... 168
American Exposition in Berlin..... 168
Navy Department Supplies..... 168
Financial Reports of Electrical Companies..... 169
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE..... 170
INDUSTRIAL SECTION:
- New Line of Motor Starters..... 172
- Low-Pressure Turbine in Textile-Mill Service..... 173
- A Prompt Delivery..... 173
- The Rothchild Engine..... 173-174
- Nernst-Lamp Improvements..... 174

Rail Handling at Gary, Ind..... 174-175
Central Electric High-Tension Disconnecting Switches..... 176
The High-Voltage Pittsburgh Transformer..... 176
CURRENT ELECTRICAL NEWS..... 177
RECORD OF ELECTRICAL PATENTS..... 184

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CENTRAL STATIONS IN SMALL COMMUNITIES.

There is no class of central stations that is more deserving of encouragement and help than the stations in the small communities scattered throughout the country. Started by local interests, as they generally and rightfully are, they are handicapped from the beginning by lack of technical and administrative knowledge of central-station principles. This has its unfortunate effects not only on the operation of the plant and the conduct of the commercial side of the business, but primarily is the cause of much poor design in equipment and ill-judged choice of policies, from which poor economy and low or no profits only can result. The outcome of this has been in altogether too many instances poor and unsatisfactory service, which has accounted for the erection of many municipal plants, that likewise have been doomed to financial failure from the start. There is no reason why these conditions must prevail, however, as is shown by the excellent success of a considerable number of small central stations that are yielding as good returns on their investment as many of the large and prosperous electric plants.

An excellent summary of the conditions that make for the financial success of the small station and for satisfactory service to the community is given in the paper by Mr. James S. Knowlson, on "Central Stations in Towns of Less Than 4,000 Population," that was presented at the recent convention of the National Electric Light Association, and which is abstracted at length on other pages of this issue. While this paper does not contain much that is radically new, it does give, from a broad point of view, a great many valuable suggestions on the design and operation of the physical plant, as well as on some of the methods that have been found successful in building up the business. For these points the paper is to be especially commended to the managers of small stations. One of the most important features of Mr. Knowlson's paper is that relating to continuous twenty-four-hour service, and he says rightly that almost every community that can support electric service of any kind will support all-day service, to the decided profit of the central-station company. Along the same lines are the advocacy of extensions to outlying communities and of broadening the scope of the plant to include all public utilities that can be economically supplied from a central station. At any rate there is no reason why such a station cannot supply electrical energy at all times for all kinds of service for which electricity is adapted.

ELECTRIFICATION ON THE SOUTHERN PACIFIC.

The daily papers a week or so ago gave wide publicity to an announcement coming from E. H. Harriman that he was in favor of the immediate electrification of the mountain division of the Southern Pacific, lying between Ogden and Sacramento. The editorial note which was published in a recent issue of the Boston *Evening Transcript* is pertinent and worth reproduction:

"When the construction of a transcontinental railroad was looked on as an exceedingly formidable undertaking great operating obstacles were anticipated in the scarcity of fuel and water. Even oil-burning locomotives were suggested in the fifties as possible means out of the difficulty. Nor were the troubles unreal. The fuel supply on the Pacific Coast remained decidedly deficient until the oil deposits of the Bakersfield region came into use. But the solution of the problem which Mr. Harriman has just ordered from Europe, by the electrification of the mountain division of the Southern Pacific, lying between Ogden and Sacramento, is one that never occurred to the apprehensive founders. Few stretches of railroad track in the country offer larger invitation to electrification than this; many miles of its course lie through tunnels and snow sheds, where the smoke is a very distinct nuisance. The snows on the mountains will afford the waterpower that can be turned into electricity. This should be much cheaper than hauling coal to these high levels and over long distances from its source. Every application of electricity is to be welcomed. The more places to which that camel can get his nose under the railroad tent, the greater the chances of his eventually finding habitation there."

SUBDIVIDING BETTERMENT EXPENSES BY MUNICIPALITIES.

Progressive and equitable regulation of central-station rates in cases of appeal to state commissions requires that a close approximation should be reached by the reviewing tribunal as to the cost of giving service in the territory concerned. Unquestionably, one of the most difficult problems in the administration of a public-utility corporation is to determine what the actual cost of service is on a given section of a railway, in a given municipality, in a telephone system, in a certain central-station district, or to specific classes of customers. To a considerable extent it is necessary for a commission analyzing a rate situation to take general cognizance of the earnings and expenses, including fixed charges, of a company as a whole; but where specific appeals come before such a board as to charges in one special location, the case cannot, as a rule, be decided fairly without going far into detailed figures as to the cost of rendering the service on a smaller or larger part of the system.

In this connection it is important for operating companies to separate their betterment expenses sufficiently so that the investment made in different sections of their territory can be readily ascertained. When a central station, for example, operates in several municipalities, it is of much importance that the approximate expenditures in each city and town shall be available in case of a rate dispute, since it may be necessary for a commission to consider the operations of the company outside the particular municipality where the complaint originates, as well as its doings in the particular territory in hand. The tax list will show the total valuation of the property in a given municipality, but this is not the cost of the work undertaken, by any means, and besides, it is generally of great importance in rate cases to be able to show that in a definite period the company has expended this or that amount of money in the territory at issue. With the almost continual expansion of physical equipment and facilities which is taking place in electrical properties, expenditures are bound to be widely distributed, and often the public does not realize at all the cost of improvements which have been made; in fact, it could not be expected to appreciate them from the money side unless the figures are brought out publicly before the commission or some other tribunal having jurisdiction. Neither is a commission certain to appreciate localized expenditures unless care is taken to present them in proper form and early in the case. The returns made by central stations to state boards usually show the cost and quantity of new work done each year by the individual companies, but they seldom subdivide the investment sufficiently to enable the proper deductions to be made. This is because the great majority of appeals to state boards in rate cases are complex questions involving both financial and technical points in engineering and traffic problems. New inquiries almost always come to the front in such cases, since novel combinations of facts and tendencies have to be made in responding to these appeals.

Obviously, it is out of the question for any company to subdivide all its operations so minutely that it can foresee the character of the rate appeals that may be made by its customers. What is needed, however, is sufficient subdivision in the company's files to enable all sorts of combined statistics to be made up, as occasion requires. In a case that was taken up some time since before a state board, the commission held that the complete operations and earnings, with the expenses also, of the company outside the disputed territory must be considered, as well as the business in the city where the complaint originated. As the outside territory was a poor one for revenue and a relatively high one for operating cost, it was to the company's advantage to have the commission call for figures external to the city proper. The longer one studies rate problems the more important it appears to be possessed of complete data, or the means of assembling it before the adjudicating tribunal.

A HYDROELECTRIC PROBLEM.

At Vernon, Vt., five miles north of the Massachusetts line, are the new dam across the Connecticut River and the hydroelectric plant designed for a capacity of 16,000 kilowatts,

as mentioned in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 13, 1909.

It is now possible to point out certain hydraulic and electric problems involved in the construction and operation of this dam and power plant that may have application in other cases.

To fully understand the situation, the profile of the river and the nature of the industries above and below the Vernon dam should be held in mind. From the dam at Turners Falls, Mass., to the foot of Bellows Falls, Vt., the distance by the Connecticut River is fifty miles, and as the new Vernon dam is twenty-two miles above that at Turners Falls, it is twenty-eight miles below Bellows Falls.

At the foot of Bellows Falls the elevation of the river is sixty-one feet above the top of the dam at Turners Falls, and it is this fall of sixty-one feet along fifty miles of the river, mostly in a rocky gorge, that the company engaged in the construction of the plant at Vernon is to utilize in part. In Massachusetts, at or near the French King rapids, which are four miles above the dam at Turners Falls and eighteen miles below the new Vernon dam, a company that is understood to be in accord with the one at Vernon is also authorized to build a dam.

Without going into a discussion of the law on the subject, it may be assumed that a plant built to utilize any part of the sixty-one feet of descent in the river from Bellows Falls to Turners Falls would be required to leave undiminished the head of water at the former and the volume of water during each hour of the day at the latter. The volume of water available during the night is important as well as that during the day at Turners Falls, because a large part of the flow there is used by paper mills, that operate during the entire twenty-four hours. It was, of course, desirable to create as much storage area as possible behind the new dam, but still the back water must not reach Bellows Falls.

On the other hand, it is expected that the electric plant at the Vernon dam will be devoted largely to the development of energy for sale in bulk for manufacturing purposes, the greater part of which may be expected to operate only during the day. It will therefore be very desirable to store large amounts of water behind the new Vernon dam during the night for use during the following day, at times when the run of the river is low.

If the use of this storage in times of low flow is not to affect the regularity of the discharge at the Turners Falls dam twenty-two miles downstream, some system of compensation appears to be necessary, and it is understood that this is to be provided by means of a dam at the French King rapids.

The pool below the Vernon dam is nearly fourteen feet above the top of the dam at Turners Falls and about eleven feet above the foot of the French King rapids. A dam at these rapids will thus create a pond in which water may be stored during the day, when the electric plant is operating at the greatest load, and then released during the night, when the river is held back by the Vernon dam, so as to produce the normal flow at Turners Falls.

Such a method of regulation may be of value at other hydroelectric plants.

THE OHIO ELECTRIC LIGHT ASSOCIATION'S CONVENTION.

The Ohio Electric Light Association prides itself on being one of the strongest and most influential state electrical organizations of the country. To anyone that attended its fifteenth annual convention, held at Toledo last week, the justice of this claim was easily manifested. There are a number of elements contributing to this strength that are worthy of mention. Among these are: The personnel of the organization, the active interest of the officers and members in its work, the custom of holding the conventions in midsummer and the lavish manner in which the association entertains its members and guests on these occasions. Of special value to the association is its recent custom of retaining a permanent secretary and compensating him for some of the time and effort required to look after its routine affairs.

This year's convention, a detailed report of which is given in this issue, was an exceptionally successful one in nearly every particular. On account of the increased financial strength of the association, it was possible to arrange the entertainment features on a much more elaborate scale even than has been customary in the past. The convention sessions, while not attended as well as might be expected from the total registrations, brought out a number of good discussions to the leading papers presented.

Among these papers probably the most significant, as indicating a marked trend of the times, were those by O. H. Hutchings and Claude Smith on "The Supply of Electric Current to Other Towns from a Centrally Located Station." In two other papers the same tendency was alluded to. One of the speakers aptly expressed the theory of this new policy for the small community by advising "if your town is too small to support a well-built plant, it were better to 'hitch your wagon to a star' of greater magnitude by running a transmission line to a larger plant." At the last Atlantic City convention of the National Electric Light Association and at a recent meeting of its Brooklyn company branch, the same sentiments found expression by some of the ablest electrical men in the country. The day of the small, poorly equipped and uneconomically operated electric plant is rapidly passing and its poor service is bound to be replaced by the far-reaching, continuous and cheaper service from a network of transmission lines, radiating in all directions from a highly efficient central station, worthy of the name. The Ohio Electric Light Association can do no better service to the small communities in its state, and by its example to those in other states, than to foster this plan of extending the blessings of electric power, light and heat to the small, yet widely scattered, centers of our rural population, and even to the farms along the lines.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

(*By Telegraph to the* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

TOLEDO, O., July 21.—The ninth annual convention of the National Electrical Contractors' Association opened this morning shortly after 10 o'clock with over two hundred contractors and guests in attendance. The opening session was marked by much enthusiasm and a fine spirit of cordiality. Marvin W. Hansen, of Toledo, national director for Ohio, made a brief address introducing the Hon. Brand Whitlock, mayor of Toledo, who felicitated the Contractors' Association upon this fine gathering and upon the importance of its work. He said that Toledo welcomed the convention with open arms and open hearts, that there were no keys, nor bars, nor walls, and that the freedom of the city was theirs entirely.

The first paper entitled "The National Electrical Code and the Relation of the Contractor to the Central Station" was read by W. H. Blood, Jr. Mr. Blood is president of the National Conference on Standard Electrical Rules and the official representative of the National Electric Light Association. He said that similarly to the rule of the triumvirate of early Roman days, the triumvirate of today in the electrical industry is formed by the code, the contractor and the central-station company; no one can rule alone, but the co-ordinated effort of all controls the situation. If a lighting company's rates are too high, its customer turns to gas or oil. If the contractor attempts to make undue profit or insists upon costly construction, the prospective customer again refuses to use electricity and as a result the contractor's business is curtailed. If the code rules are unnecessarily severe, this has the same result of decreasing the use of electricity. The code, contractor and company are like three large links in a chain, bonded together by smaller links of confidence. The latter are really the weaker and have many times been strained, but mutual tolerance and co-operation are removing the stress and welding the elements into a more substantial body. The Underwriters are making effectual efforts to bring about uniform interpretation of code rules, and through the broadening influence of attendance at various meetings for the discussion of these rules, at which the Underwriters are very glad to have the counsel of the contractors, order is being brought out of chaos and the recodified rules which will be issued shortly will bring about substantial relief. As regards competition of lighting companies in doing inside wiring, there are few companies which would not gladly turn this over to honest contractors, but where the contractor is not conscientious the lighting company is forced to do its own wiring in order to avoid permanent injury.

This paper was followed by an address by George C. Nimmons, of Chicago, who took for his topic "The Relation Existing Between the Contractor and the Architect." This was a most interesting and inspiring analysis of the fallacies of present-day contracting methods, and an intelligent discussion of the remedies which might be applied.

There was a brief discussion of this paper and a vote of thanks was tendered to Messrs. Blood and Nimmons. In the afternoon a business meeting was held. This evening the "Sons of Jove" conducted an enthusiastic rejuvenation. Exhibits of apparatus and supplies are being made by the Westinghouse Electric and Manufacturing Company, the Nernst Lamp Company, the Western Electric Company, the Charles L. Kiewert Company and the Crouse-Hinds Company. There is a large representation of manufacturers and supply men in attendance.

A. A. G.

The Philadelphia Electrical Exhibition.

A great electrical exhibition is announced to take place at the First Regiment Armory, Broad and Callowhill streets, Philadelphia, Pa., from February 15 to 27, 1910, inclusive, under the auspices of the Electrical Exhibition Compay of America, whose offices are located at 211 and 212 Baker Building, 1522 Chestnut Street, Philadelphia.

This preliminary announcement is contained in a handsome booklet which is being distributed by the company promoting the show, and with which is included a large floor plan showing the arrangement of spaces for exhibitors.

The object of the exhibition is for the avowed purpose of stimulating the electrical industries in Philadelphia and the surrounding territory. The importance of the third largest city in the country as a great manufacturing center is too well known to be enlarged upon here, but that Philadelphia contains more individual houses than any other city in the United States may not be so well known. These facts show the tremendous field for electrical activity in this territory, which is probably not equaled by any similar area in the country.

The First Regiment Armory is an ideal building for the purpose of the exhibition. It is within easy walking distance of the principal railroad stations, office buildings, department stores, and theatres, and can be easily reached by the excellent street-car system from every residential section of the city. The main auditorium has a high-vaulted ceiling, free from all obstructions, and numerous committee and retiring rooms will be available for the accommodation of exhibitors and visitors. The building will be tastefully decorated, inside and out, by experts who are originating some unique and artistic effects.

Broad Street will be specially decorated and illuminated from the City Hall to the Armory, and a well-known band will be in attendance every day of the show. Each day will be featured—as Students' Day, Municipal Day, Naval Day, State Day, etc.

A liberal policy will be followed in the distribution of free complimentary tickets to exhibitors, manufacturers, electrical and scientific societies, and others who are interested.

A Good Example.

In connection with the International and Universal Exhibition, to be held at Brussels in 1910, the Royal Commission appointed by the British Government is making extraordinary efforts to make the British machinery exhibits unrivaled among those of the various countries to be represented.

Not content with securing for British exhibitors what is probably the most favorable location for the display of their wares at the Exposition, the Royal Commission has announced that it will defray fifty per cent of the charges made by the Belgian administration for the supply of steam, gas, and electricity to British firms, when these are to be used for showing machinery producing finished articles, or for illustrating manufacturing processes. The Royal Commission is also prepared to furnish expert advice and superintendence for the erection of foundations, shafting, etc., by Belgian contractors for British exhibitors.

Southern Pacific Electrification.

Permits for the construction of power houses along the Rubicon River have recently been obtained from the government in the execution of the plan for the electrification of the mountain division of the Southern Pacific between Auburn and Truckee, Cal., on the Ogden route.

The Tariff and Its Relation to the Electrical Industry.

Washington, D. C.—Now that the fight has narrowed down to the work of the conference committee on the tariff bill, it is of considerable interest to run over the various changes that have taken place during its progress from the Ways and Means Committee hearings, as the result of which the Payne bill was presented to the House, then went to the Senate, by whom it was handed to the Finance Committee, and in time—three months—was amended and returned to the House, whence it has been placed in the tender care of the conference committee.

ALUMINUM.

The Act of 1897 provides a duty of 8 cents per pound on "Aluminum, and alloys of any kind in which aluminum is the component material of chief value, in crude form," and of 13 cents per pound on plates, sheets, bars, and rods.

Under the Act of 1890 the duty on the crude was 15 cents per pound, and in manufactured form, 45 per cent ad valorem. In 1894 this was reduced to 10 cents and 35 per cent, respectively, and, as shown above, was made specific in 1897. This was reduced by the bill as reported by the House, which reads as follows:

170. Aluminum, *aluminum scrap,* and alloys of any kind in which aluminum is the component material of chief value, in crude form, 7 cents per pound; in plates, sheets, bars, and rods, 11 cents per pound; *barium, calcium, magnesium, sodium* and *potassium, and alloys of which said metals are the component materials of chief value, 3 cents per pound and 25 per cent ad valorem.*

The items which were added to the present act are in italics. Under the present law magnesium is not dutiable, coming in free under paragraph 606, while sodium and potassium are dutiable at 20 per cent ad valorem under paragraph 183 of the Dingley Act.

The imports of aluminum in 1907 were, in crude form, 1,292,307 pounds, at a value of $258,601.40, and the duty collected amounted to $103,384.56, or an average ad valorem rate of 39.98 per cent. Of aluminum in plates and sheets we imported 10,961.06 pounds, at $7,333. On this the duty amounted to $1,424.94, or an average ad valorem rate of 19.43 per cent. Our exports amounted to $442,987. It is estimated that under the House Bill the minimum rate on the crude article will average just what it is now, although in figuring it out in the Senate it shows a reduction to 34.98 per cent ad valorem, or of 12.50 per cent. It is estimated that on the manufactured forms there will be a reduction to 16.44 per cent or of 15.38 per cent.

Sec. 3 of the House Bill would mean an increase on the crude from 7 cents minimum to 8.4 cents maximum, or 1.4 cents per pound, and on the manufactured forms from 11 cents to 13.2 cents, or 2.2 cents per pound.

Aluminum in leaf in 1890 was assessed at 8 cents per package of 100 leaves. Under the tariff of 1904 this was changed to 40 per cent ad valorem, and under the present law was switched back again to a specific rate of 6 cents per 100 leaves, at which rate it is left under both Senate and House bills. The maximum clause of the House bill would run it up to 7.2 cents per 100 leaves.

As a revenue producer this is a negligible item, as our imports in 1907 were only valued at $492, on which $261 was paid in duty, or an average ad valorem of 53.05 per cent.

Wares of aluminum are still left dutiable at 45 per cent ad valorem. The imports only amounted to $1,026.50 in 1907. The maximum rate under the House bill would be 54 per cent, or an increase of 9 per cent.

CARBON.

Under the tariff of 1890 manufactures of carbon, if undecorated, were dutiable at 55 per cent ad valorem and at 60 per cent if decorated. Under the Act of 1894 they were placed at 30 per cent and 40 per cent, respectively; but it was not until the present act that carbon was specifically named as such and increased to 35 per cent and 45 per cent, respectively, under paragraph 97. In the preparation of the bill before it entered the House, attention was called to the fact that, in the case of Dingelstedt vs. United States (91 Fed. Rep., 112), the rule was laid down by the circuit court of appeals for the second circuit that the act of 1894 should only apply to articles of this nature when decorated, and by a decision of the United States Supreme Court this was made applicable to the law of 1897, and extended it to articles of carbon, for which, as I have already stated, there was no specific provision in 1894. This ruling is said to have caused a tremendous loss of revenue to the Government, for the articles which would have paid 35 per cent have been coming in at 20 per cent. It was suggested that the remedy would be to amend the paragraph so as to provide that such articles of earthy or mineral substances as would otherwise fall within the terms of the paragraph should not be excluded because they are not susceptible of decoration, but should be dutiable under a provision for such articles not decorated. With this end in view, the House passed to the Senate this provision:

93. Articles or wares composed wholly or in chief value of earthy or mineral substances, or carbon, not specially provided for in this section, whether susceptible of decoration or not, if not decorated in any manner, 35 per cent ad valorem; if decorated, 45 per cent ad valorem.

This was materially changed while the bill was in the Senate, so that, as sent back to the House, the bill provides for:

93. Articles or wares composed wholly or in chief value of earthy or mineral substances, not specially provided for in this section, whether susceptible of decoration or not, if not decorated in any manner, 35 per cent ad valorem; if decorated, 45 per cent ad valorem; carbon, 20 per cent ad valorem; electrodes, brushes, plates, and disks, all the foregoing composed wholly or in chief value of carbon, 30 per cent ad valorem.

Under the Act of 1890 carbons and carbon pots were dutiable at 55 per cent ad valorem; and under the Act of 1894 at 30 per cent; in both instances this was in the undecorated state. The present act is as follows:

98. Gas retorts, $3 each; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, 90 cents per hundred; filter tubes, 45 per cent ad valorem; porous pots for electric batteries, without metallic connections, 20 per cent ad valorem.

Carbons for electric lighting were originally made of wood charcoal, quenched in water or mercury. They burned with brilliancy and regularity, but too rapidly. The carbon which is deposited in gas retorts was next employed, but the chief fault with this was lack of homogeneity and purity, and they are so hard that it is too expensive to cut them into pencils of the required sizes. These difficulties were overcome by purifying the gas-retort carbons, while experiments were conducted that resulted in the production of suitable carbons from other sources. In some of these processes the gas-retort carbon is used as a base, while in others lampblack is employed. In Europe the coarser fibers of manila hemp have been carbonized and successfully employed as carbons.

The number of carbons imported in 1907 was 81,792.90 hundreds, at $157,311; the duty collected amounted to $73,613.61, or an average ad valorem rate of 46.79 per cent. The imports of carbon pots during the same year were valued at $9,149, and the duty at 20 per cent, to $1,829.80.

The bill as reported to the House was as follows:

94. Gas retorts, $3 each; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, 35 per cent ad valorem; filter tubes, 35 per cent ad valorem; porous carbon pots for electric batteries, without metallic connections, 20 per cent ad valorem.

The bill as reported to the Senate reported:

94. Gas retorts, 30 per cent ad valorem; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, 70 cents per 100 feet; filter tubes, 35 per cent ad valorem; porous carbon pots for electric batteries, without metallic connections, 20 per cent ad valorem.

As passed by the Senate it was again changed.

94. Gas retorts, 30 per cent ad valorem; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, made entirely from petroleum coke, 35 cents per hundred feet; if composed chiefly of lampblack or retort carbon, 65 cents per hundred feet; filter tubes, 35 per cent ad valorem; porous carbon pots for electric batteries, without metallic connections, 20 per cent ad valorem.

It is estimated that under the present bill the average ad valorem rate on carbons is 46.79 per cent and that the proposed changes will reduce this to 36.39 per cent.

As I have shown, Senate comparisons of the two bills with present rates, show that the rates which they propose on electric-light carbons will really be lower than those at present in force, despite the contention of the House conferees that the rates have been raised.

COPPER.

The wording of the copper paragraph—174—has not, and is not now changed from what it was in 1890. Only the rate is changed. In 1890 it was assessed at 35 per cent ad valorem, in 1894 it was lowered to 20 per cent ad valorem, whereas in 1894 divisions were made which made "copper in rolled plates, called brazier's copper, sheets, rods, pipes, and copper bottoms" dutiable at 2.5 cents per pound, and "sheathing, or yellow metal of which copper is the component material of chief value, and not composed wholly or in part of iron ungalvanized,"

at 2 cents per pound. This remains unchanged in both the House and Senate bills.

Two paragraphs of the present bill, 534 and 532, have been combined to make 536 of the pending bills, but its terms are unchanged.

536—"Copper ore: regulus of, and block or coarse copper, and copper cement; old copper, fit only for remanufacture, clippings from new copper, and copper in plates, bars, ingots, or pigs, not manufactured or specially provided for in this section," Free. The provision for old copper is slightly changed. In the present act it is—

533. Old copper, fit only for remanufacture, clipping from new copper, and all composition metal of which copper is a component material of chief value not specially provided for in this act. Free.

It is proposed to change this to the following:

537. Composition metal, of which copper is the component material of chief value, not specially provided for in this section, Free.

To the iron and steel plate paragraph the House added the following clause:

Sheets or plates composed of iron, steel, copper, nickel, with layers of other metal or metals imposed thereon by forging, hammering, rolling, or welding, 45 per cent ad valorem.

The Senate has reduced this rate to 40 per cent. This clause was added because there has been a great deal of litigation on this point, and because, as it stands in the present law, the term is restricted to coatings produced by galvanizing, dipping, electrolysis, or similar processes. An appeal from that decision is now pending, and it is thought that the introduction of the clause mentioned will do away with this difficulty for the future.

A new paragraph has been inserted to provide for an assessment of duty at the rate of 45 per cent ad valorem on phonographs, gramophones, graphophones, and similar articles and their parts.

WIRE.

Telegraph and telephone wire has up to the present time been dutiable under paragraph 137, which is wholly inadequate, and reads as follows:

137. Round iron or steel wire, not smaller than No. 13 wire gauge, 1.25 cents per pound; smaller than No. 13 and not smaller than No. 16 wire gauge, 1.5 cents per pound; smaller than No. 16 wire gauge, 2 cents per pound: Provided, that all the foregoing valued at more than four cents per pound shall pay 40 per cent ad valorem. Iron or steel or other wire not specially provided for in this Act, including sheet steel in strips, 0.0025 of an inch thick or thinner, any of the foregoing, whether uncovered or covered with cotton, silk, metal, or other material, valued at more than four cents per pound, 45 per cent ad valorem: Provided, That articles manufactured from iron, steel, brass, or copper wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1.25 cents per pound, except that wire rope and wire strand shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture thereof, and in addition thereto, 1 cent per pound; and on iron or steel wire coated with zinc, tin or any other metal, 0.2 cent per pound in addition to the rate imposed upon the wire from which it is made.

The House bill provided the following rates:

134. Round iron or steel wire not smaller than No. 13 wire gauge, 1 cent per pound; smaller than No. 13 and not smaller than No. 16 wire gauge, 1.25 cents per pound; smaller than No. 16 wire gauge, 1.5 cents per pound: Provided, That all the foregoing valued at more than 4 cents per pound shall pay duty at the rate of 40 per cent ad valorem; all iron or steel wire covered with cotton, silk, or other material, * * * and all flat wires and steel strips, strip steel, or steel in strips 0.0025 of one inch thick, or thinner, whether in long or short lengths, in coils or otherwise, and whether drawn through dies or rolls, and all other wire not specially provided for in section 1 or 2 of this act, shall pay a duty of not less than 45 per cent ad valorem; or iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin, or other metal, there shall be paid 0.2 cent per pound in addition to the rate imposed upon the wire of which it is made: Provided further, That articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles, and in addition thereto 1.25 cents per pound, except that wire rope or wire strand shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture thereof and in addition thereto, 1 cent per pound: And provided further, That no article composed of wire shall pay a less rate of duty than 40 per cent ad valorem.

This the Senate first changed so that the duty on "smaller than No. 16" was increased from 1.5 cents to 1.75 cents per pound. Then the provision for "all iron or steel wire" was changed so as to include "all wire composed of iron, steel, or other metal, except gold or silver, covered, etc." The 0.0025 of one inch provision was changed to "not exceeding ten inches in width," and the duty reduced from 45 per cent to 40 per cent ad valorem. "Wire cable" was added to the wire rope and strand, and the additional duty in that clause was reduced from 1 cent to 0.75 cent per pound. Then was added this provision:

Telegraph, telephone, and other wires and cables composed of metal and rubber, or of metal, rubber, and other materials, 45 per cent ad valorem.

Still further minor changes were made and, as it has gone back to the House, the paragraph reads as follows:

134. Round iron or steel wire, not smaller than No. 13 wire gauge, 1 cent per pound; smaller than No. 13 and not smaller than No. 16 wire gauge, 1.25 cents per pound; smaller than No. 16 wire gauge, 0.75 cent per pound: Provided, That all the foregoing shall pay duty at not less than 35 per cent ad valorem; all wire composed of iron, steel, or other metal, except gold or silver, covered with cotton, silk, or other material, * * * and all flat wires, and steel in strips, not thicker than No. 15 wire gauge and not exceeding five inches in width, whether in long or short lengths, in coils or otherwise, and whether rolled or drawn through dies or rolls or otherwise produced, and all other wire not specially provided for in this section, shall pay a duty of not less than 35 per cent ad valorem, on iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin, or other metal, there shall be paid 0.2 cent per pound in addition to the rate imposed on the wire of which it is made: Provided further, that articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles and in addition thereto, 1 cent per pound: And provided further, that no article made from or composed of wire shall pay a less rate of duty than 40 per cent ad valorem; telegraph, telephone, and other wires and cables composed of metal and rubber, and other materials, 45 per cent ad valorem * * * wire headls 25 cents per thousand, and in addition thereto 40 per cent ad valorem.

KIESERITE is free under paragraph 599.

PLUMBAGO is free under paragraph 651.

POLES.

Paragraph 200 takes the place of paragraph 196 of the present act and reads:

"200—Paving posts, railroad ties, and telephones, trolley, electric-light, and telegraph poles of cedar or other woods," the duty being 10 per cent, as against the present rate of 20 per cent.

Many conflicting decisions have been rendered under this paragraph. Sometimes it has been held that when imported in a rough state they should come in free of duty under paragraph 699 as round unmanufactured timber, and in others that they should be dutiable. The contemplated reduction in the duty was made, primarily, for the purpose of admitting foreign poles, as it is claimed this will conserve our own forests. In bringing the matter to the attention of the committee it was stated that the white cedar from the North can no longer supply the demand for telegraph poles; it has been found that the cedar timber of Idaho furnishes a satisfactory substitute where heavy timbers are not required, and cypress from the Southern States has also become an important factor in the pole business. The last-named wood has been neglected as a substitute for white cedar, but that of northern Louisiana and eastern Alabama is found to be entirely satisfactory as a substitute, and the value of the timber may be expected to increase in connection with this newly found use. The same reason that is causing the railroads to look for a substitute for wooden ties—the increasing scarcity of wood—is turning attention to a substitute for telephone, telegraph and electric-light poles. Europe is now beginning to use glass telegraph poles, and patents have been granted in Germany and the United States for a machine to manufacture them.

The importations in 1907 were valued at $570,323.41, and the duty, at 20 per cent, amounted to $114,064.64.

Manufactures of VULCANIZED or HARD RUBBER are dutiable at thirty-five per cent ad valorem under paragraph 456.

ELECTRICAL MACHINERY and APPARATUS, including telephone and other instruments, will come under the provisions of paragraph 195 by assimilation, which is exactly the same as paragraph 193 of the present act, providing for

Articles or wares not specially provided for in this section, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum, or other metal, and whether wholly or partly manufactured, 45 per cent ad valorem.

An effort was made both in the House and Senate bill to include electrical machinery and apparatus under paragraph 194 at thirty-five per cent ad valorem, but this was stricken out by the Finance Committee.

MICA.

Under the law of 1890 mica was dutiable at 35 per cent ad valorem. In the Act of 1894 this was reduced to 20 per

cent ad valorem. Under the present act the rates are as follows:

184. Mica, unmanufactured or rough trimmed only, 6 cents per pound and 20 per cent ad valorem; mica, cut or trimmed, 12 cents per pound and 20 per cent ad valorem.

The paragraph which has been introduced by the House is:

89. Mica, 30 per cent ad valorem; mica plates or built-up mica, and all manufactures of which mica is the component material of chief value, 35 per cent ad valorem.

The paragraph underwent considerable change while in the hands of the Finance Committee and was reported as follows:

89. Mica, unmanufactured or thumb-trimmed only, 5 cents per pound and 20 per cent ad valorem; mica, cut or trimmed, mica plates or built-up mica, and all manufactures of mica or of which mica is the component material of chief value, 10 cents per pound and 20 per cent ad valorem.

This was afterward changed so that the first clause, as it went back to the House, reads "mica, unmanufactured, or rough-trimmed only."

Mica has been a subject of considerable dispute. In Myers vs. United States it was held that small pieces of mica which fell off in the process of thumb-trimming mica, varying in size from one to two inches in width and from two to three-and-one-half inches in length, were still mica, susceptible of use as mica, and were properly dutiable as mica under paragraph 184, against the contention of the importers that the merchandise was entitled to entry at ten per cent as waste. In another case, Shallus vs. United States, where a decision was handed down by the Board of General Appraisers, an assessment made by the collector was reversed solely on the ground that the small value of the disks made the assessed rate of duty prohibitive. The suggestion was made to the Ways and Means Committee that a provision should be made for manufactures of mica, or of which mica is the chief value; also that, inasmuch as mica is a non-metallic substance it should not be placed in the metal schedule. Both these suggestions have been acted upon.

The use of mica for stove doors is rapidly falling off, but as an insulator and for other purposes in connection with the electrical industry there is an ever-increasing demand. There is an extensive use for mica cut into small disks for electrical purposes, and the waste is used for a variety of purposes where formerly it was thrown away. The value of sheet or plate mica varies with the size of the sheet from two cents to three dollars per pound. The very lowest values, from two cents to five cents, are for small disks that are cut by machinery. Larger sheets are cut by hand, and considerable skill is required to cut the largest pattern possible from a crude block of mica. The commercial value of scrap mica before it is ground is from $8 to $10 per ton. After it is ground it is valued at from $40 to $60 per ton according to its fineness.

In 1907 we imported 3,110,029½ pounds of unmanufactured or rough-trimmed mica at a value of $1,116,320.25; duty amounted to $409,865.81, or an average ad valorem rate of 36.72 per cent. We also imported during that year 99,335 pounds of cut or trimmed at $73,364; duty paid was $26,593.01, or 36.25 per cent. The great bulk of our importations comes from Canada, other principal sources of supply being China, the United Kingdom and Germany.

A. F. TENNILLE.

Washington, July 17.

Electric Power in the New England Mills.

Within the last four or five years there has been a quiet movement among New England textile mills, which, in its natural working out, means the very general substitution of electricity for steam. At the present time there are no less than forty New England cotton mills which are either using or have orders for installing steam turbines for the generation of motive power to operate their plants. The aggregate steam-turbine capacity of these forty mills is nearly 100,000 horsepower, or exactly 98,150. A year ago there were but twenty-two mills, with a total of 41,000 steam-turbine horsepower capacity. Five years ago the mechanical operation of New England cotton mills was almost entirely dependent upon steam or waterpower.

Numbered among these mills are some of the very largest and most important in the country, such as the Amoskeag (which is using 3,000 horsepower, generated by turbines, with provision for an ultimate enlargement to 10,000 horsepower), the Arlington mills, the Nashua mills, Pacific, and Tremont & Suffolk.

The following table will show how the business of electrifying the power plants of New England cotton mills has been divided among the three largest steam-turbine producers of the country:

Company.	No. Mills Equipped.	Total Capacity in H. P.
General Electric	16	49,500
Westinghouse	13	15,000
Allis-Chalmers	11	23,450
Total	40	98,150

In still another way are the cotton mills of New England making use of electrical apparatus for power purposes. In many cases, where power is generated by water or steam, electric motors are used for the delivery of the power. At present fully 175,000 horsepower is delivered by motors in New England mills alone, and in the entire country there is some 350,000 horsepower so delivered.

The increase in the use of motors has shown a yearly average gain during the last three years of thirty per cent, better than a 100 per cent increase in the three years. Among the large centers using motors are New Bedford, with 10,000 horsepower; Lawrence, with 35,000 horsepower, including the American Woolen Company, the Pacific mills and the Arlington mills. The Amoskeag mills alone will have 13,000 horsepower of this description when additions at present contemplated are completed.

California Electric Companies Combine.

Four of the big electrical supply houses of San Francisco, Oakland and Los Angeles have consolidated and will hereafter do business under one management. These firms are named as having mutually agreed to consolidate: Pacific Electric, Los Angeles; Crescent Electric, Oakland; Brooks-Follis Electric Corporation, San Francisco; and Sterling Electric, San Francisco.

It is the intention of the new organization eventually to open offices in all of the larger western cities. Plans will be formulated at an early date to include Portland, Seattle, Spokane and Salt Lake City in the list of cities where a broad field presents itself. It is stated that here, also, the new organization will combat the strong eastern houses, which have already secured a solid footing in these places.

The provisional directors named in the organization of the new company are H. V. Carter, Pacific Electric Company, Los Angeles; William L. Goodwin, Sterling Electric Company, San Francisco; C. L. Gilson, Crescent Electric Company, Oakland, and Frank Fowden, Brooks-Follis Electric Company, San Francisco.

Service Board's Decision Reversed.

Justice Ingraham, in the Appellate Division of the New York Supreme Court, handed down a decision on July 13 upholding the New York city Board of Estimate in granting a franchise to the South Shore Traction Company to build and operate a street-railway line over the Queensborough Bridge.

The decision is a reversal of the refusal by the Public Service Commission to confirm the franchise granted to the South Shore company by the Board of Estimate.

The Commission was directed to grant the application and pay $50 costs and disbursements to the traction company.

Ohio Electric Light Association.

Fifteenth Annual Convention at Toledo, Ohio, July 13, 14 and 15, 1909.

The fifteenth annual convention of the Ohio Electric Light Association, that was held at Toledo on Tuesday, Wednesday and Thursday, July 13 to 15, was one of the best in practically every detail that this association has ever held. The convention headquarters were at the Boody House, the scene of many of its former notable gatherings. The unavoidable absence of the president and, for part of the time, of the vice-president was regrettable. Notwithstanding this, the programme of meetings and entertainments was carried out in an excellent manner. The entertainment features were particularly pleasing, and on a much larger scale than is customary for meetings of this kind. The attendance at the convention was exceptionally good, the total registration being 263. All who attended agreed that they had received much of value from the business standpoint and incidentally had had a very pleasant midsummer outing.

TUESDAY MORNING SESSION.

The first session of the convention assembled at 10 o'clock Tuesday morning, with W. P. Engel, past-president of the association and one of the active members of the executive committee, in the chair. President C. R. McKay has just a few weeks ago removed to South Covington, Ky., where he has become general manager of the local central-station company. Secretary D. L. Gaskill read a communication from him, from which the following are extracts:

"I greatly regret that my absence from the convention this year has been necessitated by change of residence. . . . . The officers and committees of the association have worked most conscientiously to provide a programme and entertainment for the members and their guests superior to those of any previous convention of the Ohio Electric Light Association, and I take this opportunity of thanking them for their cordial support and assistance. It is gratifying that this year's convention, which sets the high-water mark in membership and well being of the association, should occur coincidentally with the improved conditions in the industry which it represents. Although there are disturbing questions of corporate regulation and legislation which are as yet unsettled, the electric-light and power industry as a whole is too firmly established and too honestly conducted to fear any permanent setback from such causes. Please convey to the association my hitherto unexpressed thanks for the honor conferred upon me in my past election as president and my hope that the convention now in session will justify all the efforts made toward its success."

Albion E. Lang, president of the Toledo Railways and Light Company, delivered a pleasing address of welcome to the association on behalf of his company and the electrical and business interests of Toledo in general. In emphasizing the importance of the association's work, he called attention to the great development of the electrical industries, particularly electric railways and electric lighting, in the past twenty-five years, and to the necessity of co-operation by these industries in pushing this progress still further.

The Hon. Brand Whitlock, mayor of Toledo, also welcomed the association to the city of Toledo in a most cordial manner. He called attention to the fact that about one-half of the population of this country is urban, and that this percentage is rapidly increasing. The problems of city life are therefore steadily multiplying, and the application of electricity to the solution of many of these problems has become and will continue to be of the most potent character.

The report of the executive committee recommending the admission of fifteen new members to the association was presented by W. F. Hubbell. This report was accepted and the members duly admitted. The report of Secretary-Treasurer Gaskill was presented by him. It related chiefly to the financial condition of the association, which is now on a much better footing than ever before. There was a net balance of some $237 preceding the last convention. At the beginning of July, 1909, this was more than doubled to $490. Besides this the association has this year undertaken itself the publication of the souvenir convention programme, from the advertising in which there has netted to the association clear profits of about $1,715.

The first paper read was that entitled "Residence Lighting in Detroit," by F. T. Mather, of the Detroit Edison Illuminating Company.

This paper, which is largely quoted from a paper presented at the last annual convention of the Association of Edison Illuminating Companies, describes the conditions met with in the residence lighting in Detroit. In this city, having a population of about 360,000, there are 13,000 homes lighted electrically. There is practically no competition with other illuminants in the high-class residences, comparatively little in the moderate homes, and considerable business is done among the owners of small cottages. The majority of homes of any pretensions are invariably wired for electric service and seldom piped for illuminating gas. The Detroit residence rate is a differential one and has the peculiarity that the amount to be charged monthly at the primary rate of fourteen cents per kilowatt-hour is based entirely upon the number of living rooms in the house. Attics, store rooms, laundries, closets, bath rooms and spare rooms are not counted in determining the demand charge. The secondary rate is four cents per unit. This enables very liberal use to be made of household utensils of all kinds. As an illustration of this it was stated that one concern selling electric washing machines has placed over 450 of them in Detroit residences, particularly where the laundry work is done by members of the family. From 7,000 to 8,000 electric flatirons are used. From these the average monthly revenue is estimated to be about fifty cents. A great deal of the business is obtained without any particular effort, but active solicitation is also employed by the company, especially in filling up lines that have been extended into new territory. The residence business is considered to be very desirable. It has been found that the ratio of connected load to the district demand is more than four to one and is steadily increasing, due to the placing of convenient lights in halls, closets, etc. The hour of the maximum residence demand does not seem to vary appreciably. It comes about fifteen minutes previous to the time of the evening meal and continues until about 8 p. m., from which it falls slowly until about 10:30 p. m. The residence-district demand comes later than the business-district demand, and is falling at the time that the demand due to theatres and other places of amusement is rising. A schedule of the average monthly sales of the residence business shows that these decrease from 10 per cent in January to 4.2 per cent in June, then rise again to 13.2 per cent of the annual sales in December. The average price per unit varies from nine cents in June to 5.7 cents in December. Residence business has been found to be very stable. In hard times customers economize a little, but do not order the lights discontinued. Collections from these customers are regular and bad debts are unusual. The business is to a large extent self-propagating, as the satisfaction of one housewife is quite instrumental in inciting the interest of the neighbors in the electric service. The extensions of the lines are made into any territory that gives promise of a reasonable return.

Chairman W. P. Engel opened the discussion of this paper by pointing out that Mr. Mather has shown that residence lighting in large cities can be made very profitable, even at such extremely low rates. Most small companies have considered that residence lighting is not a very profitable branch of the business because of the large investment required for long lines and transformers.

In reply to several questions Mr. Mather said that the number of rooms in a house is the only basis upon which the

differential rates are based, and that the character and number of lamps is not taken into consideration. In regard to the meters used, a ten-ampere Fort Wayne meter is generally installed in every residence.

F. S. Duncan, of Lisbon, Ohio, said he had not found that a forty-watt tungsten lamp starts this type of meter. His company has therefore used five-ampere, and even three-ampere, meters in the smaller residences.

John Gilmartin, of Toledo, said he does not believe it advisable to use so small a meter as a five or three-ampere instrument, because its cost is almost the same as that of a ten-ampere meter. The small-capacity meter, moreover, is not good for use with flatirons and other domestic utensils.

Mr. Mather declared that in Detroit they have found the meter department the most expensive part of the business. All meters are tested twice a year in position. In regard to the residence rates he added that the minimum charge is fifty cents per month, and a ten per cent discount is given for prompt payment of bills up to $50 a month. The service is almost entirely from overhead lines, which are extended free to the outside of the building only. The company owns the meter and the lamps only inside of the building. A deposit of $5 for the meter is required from tenants; on this bank interest is allowed. Landlords of premises must give a guarantee.

Mr. Mather also spoke of the extension of electric service to the town of Royal Oak, some distance from Detroit. In this community of about 600 population the company has 189 customers out of about 200 residences and fifty business houses. In Birmingham, another village near by, within the last six months 110 customers have been obtained. The average monthly bill of the maximum residence customers in these towns is not over $2. Most of this business has been secured by personal solicitation, which scheme has been found most successful, although all other methods of business-getting have been made use of. No houses had been wired in these towns, which are small communities of people in rather moderate circumstances. Carbon lamps are furnished by the company originally and renewed. The company has not handled tungsten and other special lamps. The town of Royal Oak is about ten miles from Detroit and Birmingham some five miles farther on the same line. A voltage of 4,600 is now used on this line, although it was built for the ultimate use of 22,000 volts.

Others who discussed this question were F. M. Tait, of Dayton; F. H. Krauss, of Bellefontaine; O. B. Welch, of Dennison, and P. Barnhard, of New Philadelphia, Ohio.

Chairman Engel, in closing the discussion, predicted that the smaller companies must adopt solicitation and follow the general methods of the large companies in getting the maximum amount of new business, otherwise they must give in to the large companies.

TUESDAY AFTERNOON SESSION.

The second session was called shortly after 2 p. m. Two papers, entitled "The Supply of Electric Current to Other Towns from a Centrally Located Station," were read by Secretary Gaskill. The first paper was written by O. H. Hutchings, of the Dayton Lighting Company, and the second by Claude Smith, of the Bradford Electric Light and Power Company.

In Mr. Hutchings' paper it was pointed out that the small central station usually works under the following conditions: Limited hours of operation and no day service; simple, non-condensing engines; moonlight schedule for street lighting. The actual cost of each unit of output from such a station is necessarily high on account of the excessive coal consumption per unit output and the extremely low load factor. The investment in the generating equipment, compared with an equivalent equipment of static transformers and substation apparatus, is about in the ratio of five to one. Important advantages of purchasing the power from a larger central station are: The complete elimination of the labor costs of operating the generating station; complete elimination of the steam maintenance charges and reduction of those on the electrical equipment; the possibility of giving twenty-four-hour service and thus getting a considerable day load without additional expense other than the purchase price of the additional power. These factors bring about a decided reduction in the total running expense of a small station, and the last factor is probably the most important. The requirements for a central station distributing power to adjacent communities are: That it be equipped and operated in as perfect a manner mechanically and electrically as engineering skill and capital make possible; interruption of the service must be made next to impossible. Transmission voltages from 6,600 to 60,000 volts, or higher, may be used, depending upon the load and length of line. The station should be so located as to secure the greatest economy of operation and diversification of service.

The paper by Claude Smith described the formation of the Bradford & Gettysburg (Ohio) Electric Light and Power Company, and the installation of its transmission and distributing system. The power is purchased from the Greenville (Ohio) Electric Light and Power Company. The transmission line has a total length of twelve miles, with Bradford at the end and Gettysburg about four miles from the end. The former town has a population of about 1,600 and the latter about 350. In Gettysburg eighteen seventy-five-watt series tungsten lamps are used for street lighting. In Bradford a capacity for 150 such lamps has been provided. A minimum charge of $1 is imposed and the rates vary from twelve cents to six cents per kilowatt-hour. Practically all the wiring has been done by the company. The use of flatirons and other household conveniences is becoming quite common on account of the all-day service. There has been very little effort necessary in order to extend the service. Although in the business only a comparatively short time there are considerably over one hundred meters now connected and fifty applications on file. An effort is being made to develop power load. On the whole, the installation is extremely successful.

The discussion of this subject was opened by D. L. Gaskill, who told how the Bradford company had made its arrangements to secure its supply from his company. The rate made was three-and-one-half cents per kilowatt-hour at the border of Greenville. The Greenville company at first did not care to take on this load, but later reluctantly agreed to do so. The company now realizes what an excellent class of business it is. A small town cannot afford to put in a generating plant and to maintain it in a high state of efficiency, nor to give twenty-four-hour service. The distribution of current to small towns from a well-kept central plant is bound to increase, since it is the most economical way to reach such communities.

Claude Smith told briefly the history of the Bradford plant, which was started in 1893 by Mr. Pennington, with a very poor gasoline-engine equipment. After working for several years along unprofitable lines the plant was shut down for some five years, after which the municipality took possession of it, and likewise made a failure of its operation. The plant finally burned down. After another seven years he came back to the town and started up the present scheme, which has met with exceptional success. About ninety per cent of the lighting is by means of tungsten lamps. The transmission from Greenville is at 6,600 volts and the local distribution is on the three-wire, 220-110-volt system. Bonds for $25,000 were issued, and the company is now in shape to retire them early.

In reply to a question as to the effect of this load on the running costs of the Greenville plant, Mr. Gaskill said that it had entailed substantially no increased cost of operation.

F. M. Tait, of Dayton, pointed out that evidently, therefore, the cost of production per unit at the Greenville plant must have been reduced by this added load. He believed these two papers to be the best and most important papers presented before this convention. This matter is of great interest because in this way only can a small town get twenty-four-hour electric service at a successful price.

W. C. Anderson, of Canton, Ohio, spoke of an installation of this kind that was also very successful. E. A. Geaugue, of Edgerton, said he had just completed an eight-and-one-half-mile transmission system of this kind, from which he expected very good results. F. D. Elwell, of Sidney, spoke of a plant of this kind that took its power from a traction line. This plant has now been taken over by the city and reports from it are very favorable. He wished to know whether voltage regulators have been found necessary on such transmission systems. Mr. Smith said he had not found any need for them. He uses a sixteen-horsepower induction motor as a regulator, and has reduced his line fluctuations from maximum to minimum to only four volts.

W. S. Culver, of the General Electric Company, said as to the need of voltage regulators on lines getting power from traction systems, that this depends on

local conditions. In general, when installed they must be at the generating station. It should be noted that they can control for only one distributing center. If a number of towns are located along the transmission line it would be necessary to install induction potential regulators at each center of distribution. Where the regulator is installed at the generating end it should be at the joint expense of the traction and the transmission companies.

Mr. Smith stated in reply to questions that the maximum load on his line was now twenty-five kilowatts. The transmission line was put up complete at a cost of about $800 per mile; five-inch glass insulators were used, and had been found satisfactory up to 13,200 volts. Much trouble from trees had been met with. He advises companies to secure their own right-of-way and to have it freed of all trees. There are several farmers on his line who pay for the transformer equipment and fifty cents per month for the core losses. They take stock in the company to pay for the building of the branch lines to their farms.

A paper entitled "Engine-Room Management" was then read by F. R. Brosius, of the Columbus Railway and Light Company, Columbus, Ohio.

This paper begins with a clear statement of the qualifications of the operating engineer. The best way to get the most work out of a steam plant with the least expenditure is to find first in what particular the plant is lacking, and then to bring that part up to the highest standard. One of the most important money-making requisites of a power station is the periodic testing of the equipment. It is absolutely necessary to know what is being done by each of the elements, boilers, engines, generators and auxiliaries. The value of making flue-gas analyses was strongly emphasized. A good system of making and keeping close record of repairs is necessary. The author showed a number of typical record forms that were both compact and complete. These provided for keeping an individual record of each unit for a year and were shown to be much preferable to the old system of keeping random notes in a diary. One of the chief problems of the engineer in charge is the proper organization of the power-station force. A system of keeping a personal record of each employe is regarded as being highly desirable. Forms of such records were shown. Time checks should be made out by each employe at the end of each day's work. The clerical work in connection with the power station should be entrusted to a particular individual, if possible, who should keep record of the ordering of all material, the consumption of the fuel, oil and other supplies, the record of repairs, and also be a timekeeper for the operating force. Definite rules and regulations should be displayed conspicuously and enforced impartially.

A number of topics from the Question Box were then considered. The first related to what policy should be followed in changing the frequency of a system from 125 to sixty cycles. F. M. Tait said that it is only fair to the consumer that the company allow the cost of any changes in motors necessitated by such a change in frequency, either by making the necessary changes in the apparatus or by exchanging sixty-cyle equipment for it. The policy in this regard should be very liberal and the consumer should not be burdened on account of any changes of this character for which he is not responsible.

The second question was in regard to the type of generation and distribution in a town of 10,000. This was generally conceded to be best on the three-phase system because of the favorable opportunity this gives for power development.

Another question had to do with the policy to be followed in a power station of about 400-kilowatt capacity in order to increase the interest of the employes in the plant. Premium systems or profit sharing by virtue of increased economy of operation were advocated. In one case as the result of experience a certain amount of coal per kilowatt is set apart; thirty per cent of any actual saving in coal below this amount is allowed the employes.

The last question, in regard to lightning arresters, was set for answer by Prof. E. E. F. Creighton the next morning.

WEDNESDAY MORNING SESSION.

The first session on Wednesday was opened at 9:45 a. m. by Chairman Engel. The first number on the programme was an illustrated lecture and demonstration by Prof. E. E. F. Creighton, of Union University, Schenectady, N. Y., and consulting engineer of the General Electric Company. Professor Creighton took for his subject "Lightning Protection." He spoke first of the various types of conduction by means of slight leakage through air, brush discharge, sparks, arcs, metals, electrolytes and a type of solid conductor which does not obey the ordinary laws of resistance. For the demonstrations he had a large induction coil, to the secondary terminals of which two condensers were connected, and between these was placed the object to be tested and an adjustable needle gap. A number of determinations of equivalent needle gap were made. The lecturer estimated that he was using about 60,000 volts and a frequency of about 2,000,000 cycles in the test circuit.

The first test was of a resistance rod of the material used in conjunction with multi-gap lightning arresters. This rod, having a resistance of 100,000 ohms, had an equivalent needle gap of two inches. A choke coil of a small number of turns was found to give one-and-one-half inches for the equivalent needle gap. With a choke coil of commercial dimensions this figure rose to over two inches. In the fourth test, which was intended to show the accumulation of potential upon the end turns of transformers, a small choke coil of cotton-covered wire was used; the discharge was found to jump from turn to turn instead of passing through the coil itself. A single loop of about four feet of wire gave a needle-gap test of about one-half inch. When this loop was closed by bringing the wires together and twisting them, the equivalent gap was reduced to 0.35 inch. A multi-gap arrester having twenty-three gaps, each of about one-thirty-second inch, gave an equivalent needle gap of one-and-one-half inches; by putting a high resistance in parallel with it the equivalent gap was reduced to three-fourths inch. In the seventh and last test two aluminum-cell arresters designed for 600-volt direct-current circuits were found to give a needle gap of only a few thousandths of an inch.

From the results of these tests the lecturer argued that the use of resistance and of inductance in connection with a lightning arrester is not desirable. This was shown by the fact that each of these gave a considerable equivalent needle gap in the test, and this proved that lightning discharges or excess potentials on the line would not find a free path to ground. The multi-gap arrester he regarded as being quite good for high frequency discharges, but not for low frequencies nor for very heavy surges, although the use of shunt resistances helps in the latter particular. The aluminum-cell arrester, however, is adapted for taking care of all excess potentials, regardless of their frequency. In conclusion, Professor Creighton recommended the use of lightning arresters for the protection of apparatus and for dense distributing lines, but not generally for transmission lines.

In reply to questions, Professor Creighton said that the best protection for a building is doubtless by the use of a large number of small lightning rods instead of one only. These should be interconnected so as to form a sort of network over the house. A metallic roof grounded in several points is the best form of lightning protection for a building. The occurrence of fire on the top of a house that is provided with a lightning rod is usually caused by the fact that the rod does not extend high enough over the house to keep the arc around its extremity from striking the roof. He also said of the horn-gap arrester that, in order to make it satisfactory, it is necessary to use a resistance of such large carrying capacity so that the bulk of the lightning discharges may pass freely, that its cost is in excess of that necessary for the provision of several alumium-cell arresters. The small air gap that is placed in series with the latter does not detract from their performance, since it takes but a comparatively small potential to cause an arc to jump across this gap.

Two papers on "The Commercial Organization of Electric Lighting Companies and Their Relation to the Public," by C. C. Custer, of the Miami Heat and Power Company, Piqua, Ohio, and by W. E. Richards, of the Toledo Railways and Light Company, were read by their respective authors. A paper by N. B. Ayers, of the Dayton Lighting Company, was then read on the subject of "Boiler-Room Economy." Mr. Ayers added a caution on what he regarded as the excessive importance now being given to the commercial end of the business at the risk that the operating end is being neglected.

Mr. Custer's paper shows that the relation between company and public should be of mutual benefit, under which the consumer enjoys the service at a reasonable rate and the company secures a remunerative and permanent investment. The generating station must be well equipped and of a character to secure very low generating cost per unit of output and extreme reliability of service. If the town is too small to support a well-built plant it is better to build a transmission line to a neighboring larger plant. It is well that a considerable portion of the stock and bonds of the company be placed locally in order to strengthen the local standing of the company. In developing its business the company must advertise, advise, solicit, demonstrate, and educate the people to electric service. All methods must be made use of to build up the maximum possible load. By liberal co-operation between the company and the customer, as, for instance, by showing him how to secure the same illumination at less cost, or more illumination for the same cost, a friendly consumer is secured and the best results are obtained. The character of load that should be most eagerly sought is the daylight or off-peak load, in order that the load factor of the station may be as high as possible. Thus, by securing a good day load, the only cost that is increased is the fuel cost, as practically all other expenses remain the same and the income is materially increased. Small factories very commonly operate with steam machinery that is very inefficient, and it should not be difficult to secure them as power consumers. The light and power plant that is most progressive in business-getting methods and most active in developing its own local field generally enjoys the most prestige with its patrons and is least harassed by the bugaboo of municipal ownership.

In Mr. Richards' paper the author gives some pithy suggestions on the co-operation between the individual departments of the company organization. Electric-lighting companies succeed best when the capabilities of each employe are most fully utilized. The resultant effect upon the company's business is the algebraic sum of all the individual efforts properly directed and combined. They should assist each other for the common good. If ignored or misdirected they retard each other. It is a mistaken policy to rely upon only two or three per cent of the company's total forces, that happen to be in the selling department, instead of making every member of the force do his utmost in promoting friendship, satisfying the consumers, explaining the system, extolling its virtues and minimizing its faults. This means that there is need of the most friendly co-operation of the entire organization. Soliciting and operating forces should know of each others' doings and work in harmony. The company's policy should be known in all its departments. Each member of the organization impresses his personality, ability and character upon the composite picture which forms public opinion regarding the company. Therefore, each member, from president to coal passer, is really a part of the commercial organization. The company should make every effort to instruct its employes on matters, whether physical, commercial or political, which enhance or hinder the prosperity of its business. The attitude of the personnel to the community must be frank, accommodating, as well as intelligent and active in the company's interest. In this way a favorable public sentiment is readily built up. Misapprehensions and misinformation which are the cause of much injustice to the company are eliminated most effectively by the policies advocated above.

Mr. Ayers' paper states that since the bulk of the cost of generating electricity is spent in the boiler room, it is a fruitful field for the display of experience and training in boiler-room practice and knowledge of the art of combustion and the generation of steam. Great ignorance of these requirements is altogether too prevalent. This is shown by the great number of stokers, forced and induced draft systems, shaking grates, improved furnaces, and boiler compounds, which in four out of five cases make good their claims for increasing the boiler efficiency from ten to fifteen per cent. The first step toward economy is perfect condition of the apparatus. It is very common to cover the steam lines to prevent the transmission of heat through the walls of the pipe, but it is equally common to allow the boiler tubes to be covered with scale on one side and soot on the other and to expect to maintain perfect transmission. Leakage of air through the boiler setting is generally neglected. In the matter of operating conditions the purchase of good coal is given too little attention. The guaranteed heat-unit basis has in small plants been found somewhat unsatisfactory on account of the cost, time and labor of properly sampling and analyzing the coal. However, it is the ideal system. Economy in combustion is a matter entirely of the man in charge. A large amount of loss is occasioned by the admission of an improper amount of air to the furnace. Flue-gas analyses are of the highest value in checking this feature. A study should be made of the amount of forcing that a boiler can stand. Frequently boilers can be operated at or near twice their rating, with gain over the cost of firing up another boiler. There is no reason, on the whole, why the generation of steam has not kept pace with the generation of electricity.

A general discussion on these three papers was then taken up. D. L. Gaskill, in speaking of public relations, said the rights of the public must be taken account of by the company, and the latter must cater to public wishes. If this is not done the company will find considerable trouble in pushing its commercial campaign. In nine out of ten cases of trouble he has found that the company has been the cause by neglecting to cater to the public whim in even trivial matters. These public rights, or whims as they sometimes are, vary in different communities. The company should find out the public sentiment and prepare its service in accordance with it before any considerable agitation develops.

F. M. Tait advised that the company select some stranger to investigate what public opinion is being held among the business men of the community in regard to the public utility company. It is very difficult to get such information directly and the scheme he has found effective is to have some such disinterested investigator ascertain the standing of the company in the community. Mr. Gaskill added that he had often found that local friends of his can get from others more freely the opinion held about the company or its service than he himself could directly.

J. C. Martin, of Wilmington, says he makes use of both these plans. In his town there had formerly been a municipal plant. He believes the most successful way to get new business is to give the best kind of service. He now gives all-night and all-day service, and in five years has increased his customers from 159 to 700. He has found it effective to place the power consumers on a separate circuit, which he cuts off at 5:30 p. m. because he gives them a preferential rate for off-peak load.

In taking up the discussion on boiler-room economy, F. S. Duncan advised the use of slack coal for the sake of economy in fuel cost.

J. C. Martin had had much trouble from very hard feed-water, which was partly eliminated by digging a well about 200 feet deep. When the scale reappeared he had built a water-softening plant, which has not only removed the scale that was in the boilers, but prevented its further formation and thereby greatly reduced his fuel consumption. He is now putting in a recording apparatus for keeping accurate track of his coal and water.

Mr. Gaskill also narrated the excellent results that had followed from the installation of a water-softening system that had been constructed by his own men. His maintenance costs on the boilers have been kept down to a very low figure. A. A. Pointer, of Antwerp, Ohio, said that in his opinion the best coal was the cheapest.

At this point the executive committee, in accordance with the provisions of the constitution, selected a nominating committee to be composed of the following: William J. Hanley, E. A. Beckstein, and S. M. Rust. A motion was passed that Secretary Gaskill be reimbursed $150 for extra expenses that he had incurred in connection with the association's souvenir programme. Another motion was passed that his salary for the ensuing year be made $750 instead of $600, as formerly.

WEDNESDAY AFTERNOON SESSION.

The fourth session of the convention was called shortly after 2 p. m. on Wednesday. The paper by J. C. Rothery, of the East Liverpool Traction and Light Company, entitled "Plans to Be Followed in Supplying Lamps to Consumers," was read by Douglas A. Brown in the author's absence. Another paper on the same subject, that was announced for T. D. Buckwell, of the Toledo Railways and Light Company, was not ready for presentation, and was therefore passed; it will, however, be printed in the official proceedings.

Mr. Rothery's paper reported on the results of a study of the subject made by communicating with companies throughout the country as to the policies they adopt in the matter of renewals. The replies from about twenty companies are summarized. In these replies there was considerable difference of opinion, as some companies have very liberal renewal policies and others find it impossible to carry out this plan on such a large scale. With regard to the tungsten lamps, it seems to be the general practice to supply them at substantially cost price. Some companies have even furnished and maintained arc lamps and Nernst lamps. In general, while a few of the station managers hold the view that the central station should furnish current only, the greater majority assert that the company should supply illumination, which

means that it must undertake the maintenance of the lighting units at a high efficiency, and aid the consumer in getting the best light at the least cost.

The discussion of this paper was opened by W. P. Engel, who thought that the plan of free lamp renewals is not a good policy, particularly for the smaller companies. He has never followed it, but believes that it is the function of the central-station company to supply current at the lowest reasonable rate and to leave it to the consumer to use whatever type of lamp he chooses. W. C. Anderson, of Canton, Ohio, said he had always given free renewals of incandescent lamps, and also free maintenance of arc and Nernst lamps. He believes it a highly desirable plan. For lamps consuming over fifty watts he supplies Gem lamps.

A paper entitled "Factors Which Should Be Considered in Making Contracts for Street Lighting" was then read by S. M. Rust, of the Greenville Electric Light and Power Company, Greenville, Ohio.

In Ohio there are 143 private corporations engaged in the business of supplying electricity to the public. Of this number more than three-fourths depend upon the street lighting of their communities for financial success. The prices that should be made for the street-lighting contract depend very largely upon local conditions; each party to the contract should be thoroughly familiar with these conditions. The author groups into the following heads the factors that should be taken into consideration in fixing the price in the contract: Length of contract, kind and number of lights, changes in position of lamps, outages, schedule of burning, time of payment, costs of service, and manner of contract. As to the duration of contracts, by the Ohio statutes these are limited to ten years. Considering the requirements for this service, the contracts should not be for any period less than this. Each contract should provide that the company has the right to change its system to a newer or better one of equal or better intensity during the life of the contract. In dealing with outages it is suggested that two-thirds of the price received for lighting the lamp be allowed. The kind of lamp selected depends largely upon the size of the municipality. While arc lamps have been used almost exclusively and are in general superior, yet the introduction of the series tungsten lamps has enabled a very excellent lighting system for residence districts, where there are an abundance of trees and where the illumination does not have to be of so high an order as that on the business streets. The reports from the systems using the series tungsten lamps have all been very favorable. The author thinks that in towns of less than 5,000 inhabitants the all-night service is not justified and that a moonlight schedule is preferable. Cities above 10,000 inhabitants usually require all-night service. Bills for the street lighting should preferably be paid monthly. The letting of contracts after competitive bidding is not desirable from the standpoint of the central station having a permanent investment. The writer is of the opinion that many street-lighting contracts are made below actual cost, and he concludes his paper with an estimate of the average cost for a plant having capacity for one hundred arc lamps. The total cost thus estimated is $63.62 per year per lamp.

D. L. Gaskill emphasized the points in Mr. Rust's paper. If city councils would realize what it costs to run an arc lamp, they would be more liberal in their contracts and lighting appropriations.

Chairman Engel said he has a plant in a Michigan town in which there had been considerable municipal ownership agitation. He had an opportunity, however, to clearly and frankly state his case at a public meeting shortly before the election, at which everyone thought the municipal ownership advocates would win out by a great majority. As a result of his statement the majority went the other way. He advocated street lighting without contract. This can be done by keeping the public confidence in regard to costs and details of the work. For fifteen years he has operated a street-lighting system without contract, at $72 per open arc lamp per year.

F. M. Tait, of Dayton, said there should be a more uniform price on arc lights

J. C. ROTHERY.

J. C. Rothery, president-elect of the Ohio Electric Light Association, was born in Scotland about fifty-two years ago. He received a good academic education. In response to a roving disposition in his early youth he went to sea and rose to the mastership of a vessel. Returning to land occupations he went into railroad engineering work with the Michigan Central Railroad. He was superintendent of the cantilever bridge at Niagara Falls. In 1894 he became superintendent of the electric railway built on the Canadian side of the Falls, and retained this position after it was absorbed by the International Railway Company. January 1, 1906, he came to East Liverpool, Ohio, and assisted in rebuilding the lines of the East Liverpool Traction and Light Company and in connecting them with Steubenville, Ohio, and Rochester, Pa. His position with the company is general manager. This company forms the central link of the Ohio Valley Scenic Route, which also comprises the Ohio River Passenger Railway Company and the Steubenville & East Liverpool Railway and Light Company. He has for several years been actively associated in the affairs of the Ohio Electric Light Association and for the past year was its vice-president.

than now prevails in different communities. At present there is so much variety in these prices in various cities that the low rates granted to some communities become very quickly and generally known, and these have an important bearing upon the claims of other cities for equally low prices when contracts are to be made, regardless of the conditions prevailing locally.

Secretary Gaskill said he had prepared a list of street-lighting prices throughout Ohio and many other places in this country and abroad. This list has been supplied to the members of the Association. He is now preparing a revised and enlarged edition of the same, which will be shortly submitted to the membership.

P. Barnhard, of New Philadelphia, Ohio, said that it costs him less than $60 per year per lamp. He has had considerable difficulty, however, in making clear the actual costs to the residents of the adjoining town of Canal Dover, where the contract is about to expire and where the rates for the service have been extremely low. This community had been promised by a former company that it would have the street lights free at the expiration of the contract.

A general discussion of the conditions in New Philadelphia, Canal Dover and Bellefontaine, Ohio, was then indulged in. Secretary Gaskill thinks that the trouble at Canal Dover is due to a municipal ownership agitation started for political purposes.

George C. Osborne, of the General Electric Company, quoting from Mr. Gaskill's data, pointed out that the prices received for the street lighting varied from three to 16.6 cents per kilowatt-hour, and he called attention to the fact that each of these figures was beyond what the proper price should be. F. M. Tait added that in his opinion as little profit from the city should be made as possible in the matter of street lighting in order to keep in good favor with the municipality. Claude Smith, of Bradford, said he gets $48 per year for each seventy-five-watt series tungsten lamp, and that it was necessary to get this figure on a ten-year contract in lieu of a bonus from the town for extending the electric service to it.

THURSDAY MORNING SESSION.

The concluding session of the convention was called at 10 a. m. Thursday by Vice-President J. C. Rothery. The first business was the report of the nominating committee. Its report was accepted and the secretary instructed to cast a joint ballot for the following-named, as the officers of the Association, who were therefore declared elected for the ensuing year:

President—J. C. Rothery, general manager of the East Liverpool Traction and Light Company, East Liverpool, Ohio.

Vice-President—E. H. Beil, superintendent Youngstown Consolidated Gas and Electric Company, Youngstown, Ohio.

Secretary-treasurer—D. L. Gaskill, president Greenville Electric Light and Power Company, Greenville, Ohio.

Executive committee—F. M. Tait, of Dayton, Ohio, chairman; E. A. Beckstein, Sandusky; W. H. Hubbell, Wauseon; W. P. Engel, Defiance; Sheldon Roberts, Columbus.

Advisory committee—Samuel Scovil, of Cleveland, chairman; F. M. Tait, Dayton; D. L. Gaskill, Greenville.

Finance committee—J. T. Kermode, of Cleveland, chairman; T. D. Buckwell, Toledo; W. C. Anderson, Canton.

Publicity committee—T. H. Jungk, of Fremont, chairman; E. L. Booth, Bellaire; J. C. Martin, Wilmington.

Membership committee—W. J. Hanley,

of Cleveland, chairman; E. Van Winkle, Cincinnati; P. J. Williams, Columbus; F. C. Caldwell, Cincinnati; F. F. Rassman and I. M. Cassell, Cleveland; H. B. Rogers, Columbus.

The secretary-treasurer's financial report was again read and approved on the recommendation of the finance committee. A further report of the executive committee was submitted, recommending four additional names to the membership roll; these were duly accepted.

An amendment to the constitution relating to the selection of the nominating committee was presented by M. E. Turner, of Cleveland. It sought to have this committee composed of five members, two to be elected in open convention, two selected by the executive committee and one chosen by the retiring president, the idea being to prevent control by any clique. Its adoption was deferred until a special committee of three (Messrs. Tait. Turner and Hard) reports on this matter at the opening of the next convention.

A vote of thanks was tendered the Toledo Railways and Light Company, the Hotel Boody and to others of the local committee that had contributed to the success of the convention.

The paper on "The Titanium Carbide Arc Lamp" by C. R. McKay, late of the Toledo Railways and Light Company, was read by W. E. Richards, of that company.

Within the past ten years the street-lighting industry has passed from the direct-current, open-arc lamp to the magnetite, titanium carbide, and the flaming arc lamps. Of these the latter, while highly efficient and possessing the possibility of controlling the color of the light, is regarded by the author as objectionable on account of its frequent trimming, obnoxious fumes and undesirable distribution. The metallic oxide, or magnetite, lamp is at the present time, in his opinion, the best lamp for street lighting, since it combines high efficiency, pure white color, excellent distribution, long life and low maintenance cost. These lamps are rapidly replacing the series alternating enclosed lamps. After describing the magnetite lamp somewhat in detail, the further advantage it possesses is stated to be its adaptability for operation from alternating-current generators of any frequency through a simple rectifying system. To eliminate the necessity for this rectification, a lamp is now being developed which is capable of being used directly on series alternating-current circuits. This is the titanium carbide lamp. Its characteristics are: High luminous efficiency, approaching one-third of a watt per mean horizontal candlepower; the cost of electrodes is at present high, about twenty cents per trim, and constitutes the principal item in the operating cost of the system; the light possesses a yellow tinge, which is objectionable; the arc is unsteady and the slag condensed from the vapor of the arc may become fused into the globe; the power-factor of the circuit of these lamps is seldom higher than fifty-five per cent because of the reactance necessary to steady the arc. At the present time three tentative installations of these lamps are in operation—at Rochester and Schenectady, N. Y., and Haverhill, Mass. The lamp is a plain series lamp, without shunt winding or regulating device. There is an oil switch in series with the circuit, which is automatically opened and closed by a clock-controlled relay at definite feeding intervals. There are two series magnets which raise the upper electrode to the proper arc length, at which it is held until the station relay momentarily interrupts the current through the entire circuit and allows the upper electrode to drop. The oil switch then closes and the current through the lamp magnets again draws the arc. The upper electrode is a round stick, chiefly of titanium carbide. There are two lower carbon electrodes inclined to form an inverted V. Ventilating arrangements are necessary to keep the fumes and condensed vapor from depositing on the globe or lamp mechanism. The efficiency of the system is given as ninety-five to ninety-seven per cent and the power-factor from fifty to sixty per cent at full load on sixty cycles. A constant-current transformer is included in the circuit, a 100-light unit being arranged for two series circuits. This type of lamp has been developed not with the idea of displacing the magnetic lamp, but to supplement it and to enable the use of alternating current in the lamp circuit itself. Until it shall be commercially practicable to produce satisfactory arc lighting from unrectified alternating current at twenty-five cycles, the magnetite system will remain the preferable and most efficient means of arc lighting from low-frequency systems. At the conclusion of the paper are given a number of distribution curves, circuit diagrams, and sketches of the titanium carbide lamp and its mechanism.

At this point there was a general discussion on tungsten lamp experiences. This was participated in by E. L. Booth, of Bellaire, Ohio; W. E. Richards, Toledo; E. H. Beil, Youngstown; W. C. Anderson, Canton; M. E. Turner, Cleveland; J. C. Rothery, East Liverpool; L. A. Pettit, Jr., Middletown; O. H. Hutchings and F. M. Tait, Dayton; G. C. Osborne and H. Schroeder, Harrison, N. J.

In this discussion there was no dissent from the general opinion that the tungsten lamp had been a boon to the electric lighting industry. Excellent results have been achieved with it in every class of illuminating service where it has been used. Exceptionally successful was the use of the series tungsten lamp in street lighting. Mr. Schroeder, of the General Electric Company, said that about ninety per cent of the carbon lamps lately used in series incandescent lighting were now replaced by tungsten lamps. The use of tungsten sign lamps is rapidly increasing. Mr. Tait spoke of the ornamental posts now being installed in Dayton for the special tungsten street lighting.

President-elect Rothery made a brief address, expressing his gratitude for his election to preside over the affairs of the Association for the coming year, which he hoped would continue to extend its benefits and influence to a still greater degree.

A vote of thanks was tendered to W. P. Engel for presiding over the earlier sessions, and to the retiring president, C. R. McKay, for the important part he had taken in arranging for the success of this convention. The convention was then adjourned.

ENTERTAINMENTS.

The Ohio Electric Light Association has become famous, among other things, for the liberal scale in which it entertains its members and guests at the annual conventions. The entertainments this year were carried out in a more elaborate manner than has been customary even for this association.

During the day while the convention sessions were in progress entertainment was afforded for the ladies in the nature of an automobile ride to points of interest around Toledo on Tuesday afternoon and a trip by launches on the Maumee River to Fort Meigs and return on Wednesday morning.

At 5:30 p. m. Tuesday special cars were provided which carried the members and guests to the Casino at Lake Erie Park, where a dinner was enjoyed in the pavilion over the lake. In the evening the party went into the theatre to witness a performance of "The Girl from Rector's."

Wednesday at 4 p. m. a trip was made to Toledo Beach, on the Michigan shore of Lake Erie, via special electric cars. On reaching the beach a majority of the party went in bathing and at half-past six partook of an excellent frog-leg and chicken dinner in the open air on the lawn. Later in the evening there was dancing at the pavilion, interspersed with a variety of amusements afforded by the improvised "Order of Turkey Buzzards," who furnished much merriment on this and other occasions by their eager search for candidates, as well as by the band music, songs and other stunts that they indulged in.

On Thursday at 2:30 in the afternoon a special train on the Lake Shore & Michigan Southern Railroad was provided for taking the convention party to Sandusky, Ohio. On arriving there at the main boat landing boats were taken across the bay to Cedar Point. Headquarters were established at the Hotel Breakers, where, at 6:30 p. m., a banquet was given in honor of the Association. Later in the evening there was a tour of the amusements, particularly the picturesque lagoons on the Point, followed by dancing in the ballroom. After this the convention broke up and the members departed in various directions to their homes. The excursion to Cedar Point was marred considerably by a long and very heavy downpour of rain.

EXHIBITS.

The associate member companies, as usual, made exhibits of their latest electrical appliances in various rooms of the parlor floor of the hotel, and also in its main corridor. These were visited by all the members and examined with great interest.

The General Electric Company had an exhibit comprising toasters, flatirons, percolators, chafing-dishes, cigar-lighters, tungsten lamps of all kinds, including the new sign lamps, oscillating fans, the new intensified arc lamp, and a new vibrating rectifier panel for charging small storage batteries, and Professor Creighton's outfit for the demonstration of lightning phenomena. Among those rep-

resenting the company were F. H. Gale, H. Schroeder, G. C. Osborne, W. S. Culver, F. T. Benson, W. J. Hanley, E. E. F. Creighton.

The Westinghouse Electric and Manufacturing Company had on display an "Electric Favorite" range, disk stoves, flatirons, and various other heating devices, fans, a variety of tungsten lamps, including the new Westinghouse series lamp and the five-watt lamp for sign lighting, motor-driven devices of various kinds, including the new utility motor, various integrating wattmeters, and other portable instruments, multiple and metallic arc lamps, transformers and other apparatus. Among the company's representatives were J. C. McQuiston, S. A. Fletcher, W. B. Wilkinson, A. E. Rickards, J. W. Schrantz, E. W. McAdams, A. B. Fishel and R. W. Beebe.

The Nernst Lamp Company had an extensive display of single and multiple-glower units of various sizes in both inexpensive and highly ornate fixtures. The new instantaneous lighting units, which have a special carbon filament for the heater, attracted particular attention. The company was represented by Max Harris, H. M. Brown, J. J. Sorber, J. L. Anderson and S. P. Wilbur.

The Adams-Bagnall Electric Company had one of its new regenerative flaming-arc lamps hung at the entrance to the hotel. J. H. Worbs represented the company.

The Allis-Chalmers Company showed the following apparatus in the main lobby of the hotel: A portable air-compressor set, direct-current motor, a polyphase induction motor, a transformer, and a steam-turbine section. Among the company's representatives were C. B. Cook, F. C. Colwell, G. P. Fairbanks, and L. Gugenheim.

The Pittsburgh Transformer Company showed two types of its transformers in the exhibition room. In charge of the exhibit was P. H. Butler.

The Wagner Electric Manufacturing Company had an exhibit of its single-phase and polyphase induction motors. The company's interests were looked after by Dean Emerson, A. B. Hoffman and Arthur B. Shepard.

The Weinman Manufacturing Company, of Columbus, Ohio, had an exhibit of electrically driven pumps in charge of William A. Wolls.

The Fort Wayne Electric Works showed an extensive line of Fort Wayne fans. The company was represented by G. B. Edgar and Mr. Ryan.

The Tungstolier Company had an exhibit of its folding tungstolier fixtures, in charge of T. M. Roche and W. S. Reynolds.

The Holophane Company had an exhibit of various examples of its glassware, and also of the new line of D'Olier metallic shades, in charge of C. S. Davidson.

The Pacific Electric Heating Company had a display of its toasters and "hot point" electric flatirons, in charge of Henry F. Holland, manager of the Chicago office.

The Manhattan Electrical Supply Company, of Chicago, had a large line of supplies on display. Norman S. Richmond represented the company.

The Electric Suction Sweeper Company, of New Berlin, Ohio, made a demonstration of the Hoover electric suction sweepers by its representative, A. W. Wasey.

The Charles L. Kiewert Company displayed an Alba and an Aurola flaming-arc lamp in the main lobby of the hotel. M. W. Hansen looked after the company's interests.

The F. Bissell Company, Toledo, was strongly represented at the convention, among its representatives being F. Bissell, W. J. Bissell, H. E. Allen, A. O. Clingman, L. C. Crabbs, C. M. Hamilton.

The National Carbon Company was represented by N. C. Cotabish, A. G. Summerell and A. B. Pike.

The Shelby Electric Company, Shelby, Ohio, was represented by George Loring, W. H. Myers and J. Feighner.

H. H. and F. M. Cudmore represented the Brilliant Electric Company, of Cleveland.

M. A. Watterson looked after the interests of the Erner Electric Company, of Cleveland.

The Bryan-Marsh Company, Chicago, had among its representatives J. S. Corby and G. E. Arboquist.

The Cleveland Electrical Supply Company was represented by H. F. Ackerman and C. L. Bogner.

The Electric Appliance Company, Chicago, was represented by F. J. Alderson.

J. W. Brooks represented John A. Roebling's Sons Company.

The H. W. Johns-Manville Company had R. R. Braggins to look after its interests.

The Electric Storage Battery Company was represented by A. N. Bentley.

The Standard Underground Cable Company, Pittsburg, Pa., had Ralph B. Wilcox as its representative.

The National Metal Molding Company, of Pittsburg, Pa., was represented by J. A. Campbell.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN was represented by P. S. Dodd, F. H. Bernhard and F. R. Schalck.

The General Incandescent Lamp Company was represented by H. C. Rice.

W. Reynolds represented the Doubleday-Hill Electric Company, of Pittsburg.

The Triumph Electric Company, Cincinnati, was represented by W. H. Jacob.

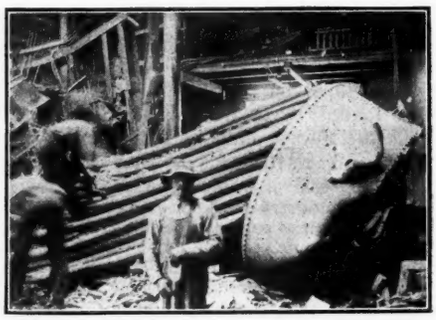
Second Avenue Railroad.

Judge Lacombe, in an order signed last week, in the United States Circuit Court at New York, extends the time for all parties to take testimony in the foreclosure proceedings instituted by the Guaranty Trust Company against the Second Avenue Railroad Company, of New York city, until October 9.

An Accident and a Quick Recovery.

On June 15 last, at the West Station of the Denver Gas and Electric Company, a 400-horsepower boiler exploded, shot upward and backward, clearing a row of eight smokestacks, each 125 feet in height, descending through the roof of the building into the engine room. In its downward flight, the exploded boiler tore through the switchboard-gallery floor, landing upon two generators below. The latter were practically demolished. The engine operating these generators was considerably damaged, but not irretrievably so.

In the switchboard gallery havoc was wrought. All of the leads from the generators to the switchboard were cut off, which interrupted service in nearly the entire city. Many of the boosters were injured and five went down to the floor below with the boiler. Most of the gen-



BOILER AFTER THE ACCIDENT.

erator switches and rheostats were more or less seriously injured.

The end of the boiler room was blown away, and where the boiler descended through the roof a large hole was made. Thunder showers for several days following gave considerable trouble and hindered the repair work.

However, the entire incandescent lighting service was restored four hours after the accident, and the direct-current service resumed within twenty-four hours. Within four days, the entire service was in operation.

As a result of this accident, four men are dead and four others seriously injured. The latter will recover, however.

The cause of the explosion is not determined.

Electrolytic Sewage Disposal.

The electrolytic plant for the treatment of sewage at Santa Monica, Cal., has given the utmost satisfaction after being in operation for a year. The average monthly cost was $400, of which about $150 was for electric current.

The Manufacture of Artificial Nitrates from the Air in Norway.*

BY JOHN B. C. KERSHAW.

One of the most important and pressing problems of our modern civilization is how to increase the yield of the world's food crops without impoverishing the soil upon which they are grown. Three chemical substances, nitrogen, potassium and phosphoric acid, are essential for the healthy development of all plants, and are being constantly extracted from the soil by the crops grown upon it. It is therefore necessary that these substances should be supplied to the soil in some form in which they can be assimilated by the growing plant. The frequent application and digging into the ground of natural or artificial manures is thus an essential condition for the continuance of good yields of cereals from the soil. Of the three substances named, the nitrogen is probably the most important.

The nitrogen required by the soil in the early days of agriculture, and down to comparatively recent times, was entirely supplied by farmyard manure. This is still largely used, though supplemented by combined nitrogen from two other sources, viz., the deposits of nitrate of soda in South America, and the nitrogen contained in the coal measures, which is recovered as sulphate of ammonia when the coal is gasified. Coal contains on an average 1.3 per cent of nitrogen, and of this amount about seventy per cent can be recovered as ammonia when the coal is converted into gas. The growth of the production of nitrate of soda and sulphate of ammonia is most striking, and is largely due to the demand for agricultural purposes. The output of nitrate of soda (or Chili saltpeter, as it is called) is now at the rate of 1,500,000 tons per annum, and the consumption has doubled during the last fifteen years. As regards sulphate of ammonia, the output is growing rapidly, owing to the increased number of works in which coal is gasified and the by-products recovered, and is probably now over 500,000 tons per annum. But both these sources of combined nitrogen must ultimately fail, for the nitrate grounds of South America and the coal measures of the earth are themselves limited in extent, and at some future date they will be exhausted, or will become economically inaccessible.

It is therefore satisfactory to know that two distinct electrical processes have been invented, and are now working upon an industrial scale, for tapping the immense reserves of nitrogen existing in the atmosphere, and for converting this nitrogen into a combined form available for the needs of agriculture. The first of these is the Birkeland and Eyde process, in which an electric arc flame is employed to raise the air to a temperature of 3,000 degrees centigrade. At this temperature nitrogen and oxygen combine, with formation of nitric oxide gas, although the reaction is not purely thermal in character as the earlier investigators thought. The nitric oxide obtained in this way is cooled, then oxidized to a higher state and is finally passed through absorption towers containing water and milk of lime. The end product of the process is basic nitrate of lime, and this is either sold as such, or is mixed with forty per cent of ammonium sulphate to give a stronger and less hygroscopic artificial manure.

The second process for fixing the nitrogen of the air in combined form is known as the Frank and Caro process. The product in this case is a compound known to chemists as calcium cyanamide, but known to the trade as "kalkstickstoff" or "lime nitrogen." The process is based upon the fact that calcium carbide when heated to a temperature of 1,100 degrees centigrade in an atmosphere of nitrogen, absorbs this gas with great avidity, and yields a compound of the cyanide type of which the chemical formula is $Ca(CN)_2$. The process, therefore, requires calcium carbide and nitrogen as raw materials, and apparatus for bringing these two into contact at a high temperature. The calcium carbide required for the manufacture is produced in the usual manner by heating lime and coke in an electric furnace of the resistance type, to a temperature of 2,500 degrees centigrade. The nitrogen is obtained by the fractional distillation of liquid air, this latter being produced by the Linde apparatus, in which the air is first compressed and is then cooled to 194 degrees centigrade below freezing point. The absorption is carried out in retorts of special design, filled with the finely crushed carbide and connected with the nitrogen supply.

The present article will be confined to a description of the large developments now occurring in Norway in connection with the Birkeland and Eyde process. This process has been worked upon an industrial scale at Notodden in Norway since May, 1905. The plant at this place at first consisted of three 700-horsepower furnaces, each producing nitrates equivalent to 325 tons of nitrate of lime per annum. Three months after starting, the electrical generators were destroyed by fire, and much delay occurred before the special construction and financial difficulties caused by this disaster were surmounted. Herr S. Eyde in February of the present year, gave a detailed history of the financial side of the development of the undertaking before a meeting of engineers in Christiania.[1] In the course of this address Herr Eyde emphasized the fact that without the ready support of Swedish and German financiers, the process and works would have been a failure. The few friends who financed the first experimental installation of plant at Notodden drew back when further support was required, and had it not been for this outside help, the history of the undertaking would have been very different from that recorded today. Nearly $300,000, in fact, was expended upon experimental work before the process became an assured success, and capable of earning the profits named by Herr Eyde in his statement. It is unnecessary in this article to repeat the details of the successive stages in the financial development of the great undertaking. After several intermediate companies had been formed and absorbed by still larger companies, the decision was made to create one company which should take over the two power development schemes, and another which would deal with the utilization of this power for nitric acid and nitrate production—an amalgamation with the Badische Anilin und Soda Fabrik—being part of the latter scheme. The title of the first company is the Norsk-Kraftaktieselskabet and its capital is 16,000,000 kroner (equivalent to $4,275,000). This company takes over the present power station at the Svelgfos Falls, where a plant of 47,000 horsepower is already installed, and is also charged with the still larger power development scheme at the Rjukan Falls, where a total of 250,000 horsepower is

* Since this article was written two important papers on "Nitrate Production from the Air," have appeared—the one by Sam Eyde was read before the Society of Arts, London, on May 26, and the other by Director Bernthsen, of the Badische Anilin und Soda Fabrik, was read before the International Chemical Congress, on May 29.

[1] "*Zeitschrift für Electrochemie*," No. 5, 1909, p. 146.

available for industrial use, and only awaits development.

The second company is named the Aktieselskabet der Norske Salpeterverket and possesses a capital of 18,000,000 kroner (equivalent to $4,810,000). This company is to control the utilization of the power for the fixation of atmospheric nitrogen, under the Birkeland and Eyde and Badische Anilin und Soda Fabrik patents, and will extend the nitrate works at Notodden and at Vanna, as rapidly as required by the developments of the power. At the date of Herr Eyde's address a total of 22,000,000 kroner ($5,880,000) had been expended upon the developments at Notodden, Svelgfos, Rjukan and Vanna; of this total eighty per cent had been spent within the country and had benefited Norwegian works and workers.

It is expected that all the development work will be completed by the end of 1910, and by then an outlay of 54,000,000 kroner, or $14,430,000, will have been made.

As regards the financial prospects of the undertaking Herr Eyde is naturally sanguine. Even supposing that 500,000 horsepower in Norway were harnessed and applied to the new manufacture, this would only produce 300,000 tons of nitrates annually, and the necessary engineering works and plant could not be completed under ten years. According to Herr Eyde, however, Chili is now exporting 1,800,000 tons of nitrate annually, and by 1920, will probably be producing 2,500,000 tons per annum. The Norwegian output in 1920, even supposing this enormous extension of the industry has occurred, will only be one-eighth of the Chilian production, and with such disproportion between the two sources of supply, it is unlikely that any marked fall in value can occur. The financial results of the manufacture at Notodden so far have been satisfactory. In the year 1908, a net profit of 500,000 kroner ($133,600) was made, while the total receipts were 2,000,000 kroner ($535,000). The balance of 1,500,000 kroner ($401,400) was accounted for by the costs of running the plant, and general expenditure and depreciation charges. The average power used during the year was only 13,000 kilowatts, in place of 22,000 kilowatts, for which the plant is designed when in full working order.

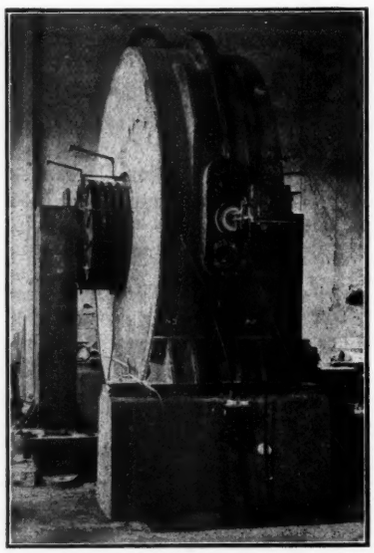


FIG 2.—EXTERNAL VIEW OF BIRKELAND AND EYDE FURNACE.

During the latter six months of 1908 the Notodden works have been running on an average with 15,000 kilowatts, and for this shorter period the sales receipts have been $400,500, while the running costs and other charges have totaled $258,990, leaving a net profit of $141,510, or $283,020, calculated upon twelve months. This profit has been really earned upon a capital outlay of $2,837,000, and represents 9.6 per cent on the investment. When the plant for manufacturing ammonium and potassium nitrates is completed, still better results are expected.

The original portion of the plant at Notodden comprises three 700-horsepower furnaces, capable of dealing with 75,000 litres of air per minute. Fig. 1 shows a sectional elevation of the furnace, Fig. 2 an external view, and Fig. 3 a view of the three furnaces in the furnace room. The electrodes of these furnaces are formed by water-cooled copper tubes, and the air from which the nitrogen oxides are formed is forced through channels AAA into the chamber B, where it is brought into intimate contact with the electrodes and the arc, before escaping by the passages marked C C.

The spark discharge, when passed between the poles, is caused to spread out into a disk of flame by means of a magnetic field, formed at right angles to the path of discharge. The water-cooled electrodes approach one another within one-third of an inch, and the diameter of the electric disk flame produced is over six feet. The fire chambers of the furnaces are only from two to six inches in width, and they are lined with fire brick. The hot gases which issue from the furnace pass through a steam boiler, where a portion of the heat is utilized for steam generation. In this way the temperature is reduced to 200 degrees centigrade, and by passing through another cooling apparatus it is reduced to fifty degrees centigrade. At this temperature the gases enter two large oxidation chambers with

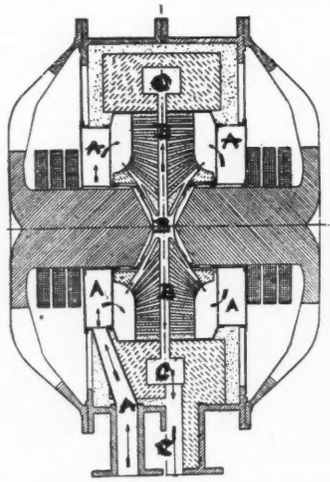


FIG. 1.—SECTIONAL ELEVATION OF BIRKELAND AND EYDE FURNACE.

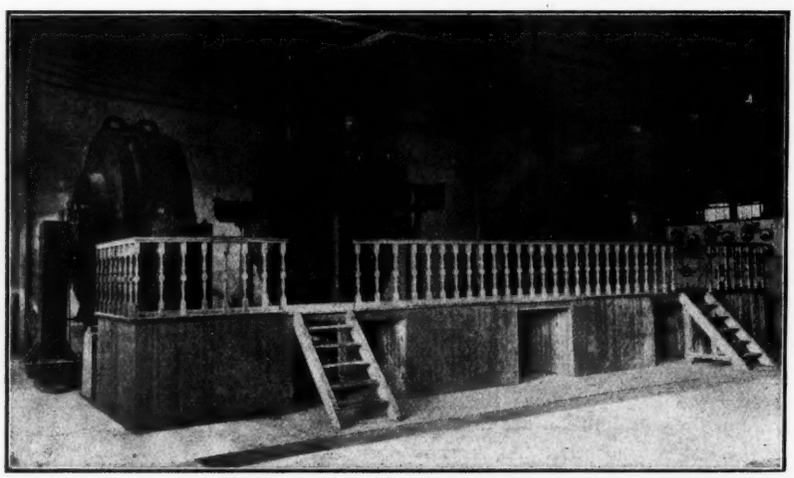


FIG. 3.—ELECTRIC FURNACE ROOM AT THE NOTODDEN NITRATE WORKS.

acid-proof linings, and finally pass to the absorption towers shown in Fig. 4.

These are fifty to eighty feet in height, are built of granite slabs, and are filled with lumps of quartz, over which water trickles. No. 1 tower produces fifty per cent nitric acid, No. 2 tower twenty-five per cent acid, No. 3 fifteen per cent acid and No. 4 five per cent acid. When working under normal conditions, the liquid from Nos. 4, 3 and 2 towers is pumped back through the series by means of a pressure chamber and air pump, as in the sulphuric acid manufacture, Fig. 5. The gases finally pass through a similar tower, down which milk of lime flows, and then through a wooden vessel or chamber filled with beds of quicklime, before they pass into the atmosphere. Fig. 6 shows the method of feeding the absorption towers with acid or water.

FIG. 4.—ABSORPTION TOWERS AT THE NOTODDEN WORKS.

The fifty per cent acid obtained from No. 1 tower is added to limestone, and the solution is concentrated until the residue is anhydrous nitrate of lime, containing thirteen per cent nitrogen. While in the molten state this salt is poured into iron drums of the form and size shown in Fig. 7, and is then ready for shipment.

The enlarged works at Notodden consists of thirty-six 1,500-horsepower furnaces and nine absorption towers; the annual capacity is 20,000 tons of nitrate of lime per annum, valued at $1,000,000.

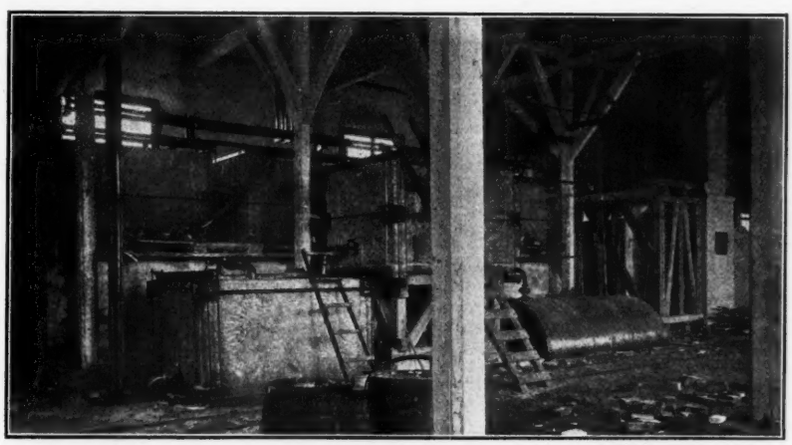


FIG. 5.—TANKS AT BOTTOM OF ABSORPTION TOWERS.

It was estimated that the original plant at Notodden would produce 500 to 600 kilogrammes of 100 per cent nitric acid per kilowatt-year (equivalent to 1,000 kilogrammes basic nitrate of lime) and that the cost would be about $7.20 per metric ton, with power costing about $4 per kilowatt-year. In the early experiments from seventy-five to 200 kilowatts were employed for each arc, alternating current at 500 volts and fifty cycles per second being employed.

As already stated, the generators in this early plant were burned out three months after starting the same. A commission of experts was appointed to examine the generators and report upon the special difficulties of the work. Alterations in their design were made, and the delay consequent upon the construction and installation of this new plant stopped production in 1906 and reduced the output for the year 1907. It is, in fact, only since the middle of 1908 that the manufacture has been run upon the large scale which is estimated to produce the best results.

The hydraulic engineering works at Notodden comprise an embankment which increases a natural fall of the Svelgfos from thirty-two to 140 feet. A conduit 1,130 feet in length conveys the water to the penstock chamber—the volume of water available is 16,500 gallons per second. The turbine house is built in a narrow defile, close against the foot of the precipice, and in place of pipe lines four perpendicular galleries have been driven through the rock down to the tunnel connecting with the turbines. There are four turbines, each unit being 11,750 horsepower; the vertical shafts of these are directly coupled to the dynamos. These machines have been supplied by the firm of Voith of Heidenheim, and they are among the largest yet constructed in Europe.

The generating station when completed will yield 47,000 horsepower, and the whole of this power is to be utilized in the nitrate factory at Notodden, which is five kilometres distant from the power station. A second factory at Christiansland is equipped partly with the Birkeland and Eyde type of furnace, already described, and partly with the improved furnace patented by the Badische Anilin und Soda Fabrik. In this furnace arcs of great power are produced by use of an iron tube three feet or more in length, at the end of which an insulated electrode is placed, while a single electrode connected electrically to the tube, is inserted at the opposite end. On passing the current through this tube, an arc is established between the insulated electrode and the wall of the inner tube, and when air is blown into the tube with a whirling motion, this arc travels along the interior of the tube to the opposite electrode, burning all the time with great steadiness. This

form of furnace has several advantages, since the tube can be jacketed and the heat of the gases at the upper end utilized on the counter current principle, to heat the incoming air. The heat still contained in the gases after the reaction can also be applied to evaporate the solution obtained in the latter stages of the process. It is stated that this tube type of furnace is more efficient than the original Birkeland and Eyde furnace, and that two per cent of nitric oxide is obtained in the gases passing away from the furnace.

FIG. 6.—DISTRIBUTING APPARATUS ON TOP OF ABSORPTION TOWERS.

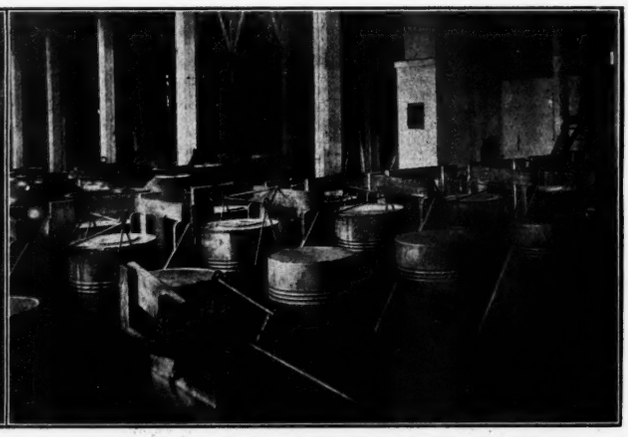


FIG. 7.—PACKING NITRATE OF LIME IN DRUMS.

As already stated, this improved type of furnace has been installed in one portion of the extended works at Christiansland, while for the still larger nitrate factory at Vanna for utilization of the power developed from the Rjukan waterpower, the Badische Anilin und Soda Fabrik furnace is to be employed exclusively. The power station at this place is to be built in two sections, as the head of water is too great to be safely utilized in one station. It is hoped that the first portion of 25,000 kilowatt capacity will be ready for operation in 1910. Few details of the engineering work on this scheme have yet been published, but there is said to be a water flow of 1,589 cubic feet per second and a head of 1,830 feet, which is equivalent to a power development of 220,000 horsepower. According to H. D. Pierce, the American minister at Christiania, the concessions for the utilization of these two large waterpowers (Svelgfos and the Rjukanfos) were obtained some years ago, and the Norwegian government is now much more strict with regard to the development of Norwegian waterpower resources by the aid of foreign capital.

Haber and Koenig have recently published results of investigations into the theory of the oxidation of nitrogen in the electric arc, which appear to prove that the reaction is not purely thermal in character, and that a higher yield of nitric oxide can be obtained by operating the process at a much lower temperature than has been customary. Working with temperatures much below 3,000 degrees centigrade, they obtained yields of ten per cent of nitric acid when air was employed and of 14.5 per cent when mixtures of oxygen and nitrogen in equal parts were used, as compared with five per cent in the Birkeland and Eyde process. According to Haber and Koenig the reaction is partly ionic in character, and an increase in the yield can be obtained by improving the ionizing action of the arc. If this theory is correct, and if Haber and Koenig's improved efficiency can be maintained in experiments on a large scale, it would apear that finality has not by any means been reached in the design of electric furnaces for the production of nitric oxide from the air, and that the new Badische furnaces now installed at Notodden may soon give place to yet another type of furnace.

In conclusion, the author must place on record his thanks to the manager of the Notodden Salpeterfabrik Company for the photographs of the Notodden works illustrating this article. The papers by Professor Frankland and by Professor Birkeland, referred to below,[1] have been drawn upon for some of the facts and figures, while an article contributed by the author to the *Manchester Guardian*, in 1908, has also been similarly utilized.

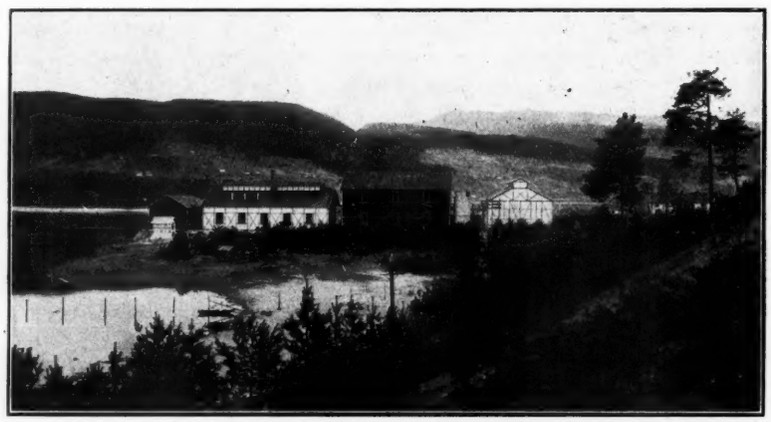


FIG. 8.—GENERAL VIEW OF NOTODDEN WORKS.

Big Storage Battery Company.

Articles of incorporation have been filed at Albany for the Westinghouse Storage Battery Company of New York, with an authorized capital of $1,750,000, $100 shares, of which $250,000 is six per cent preferred. The directors are: H. H. Westinghouse, Samuel B. Dusinberre, George C. Smith, H. Cool and John G. Greenburgh. They will assume the business of the storage battery department of the Westinghouse Machine Company.

[1] "On the Oxidation of Atmospheric Nitrogen in Electric Arcs," by Kr. Birkeland. Transactions of the Faraday Society. Vol. II, December, 1906.—"The Utilization of Atmospheric Nitrogen," by Professor Frankland.—Journal of the Society of Chemical Industry, March 15, 1907.

Association of Iron and Steel Electrical Engineers.

The second annual convention of the Association of Iron and Steel Electrical Engineers was held at Buffalo, N. Y., from June 23 to 25.

On June 23, which was designated as "Members' Day," the president, John C. Reed, gave his annual address, and the reports of the treasurer and the secretary were presented. The standardizing committee and the safety committee presented reports which were read and discussed. E. W. Yearsley and P. McN. Bennie each delivered a lecture on the electric furnace.

On June 24, which was designated as "Visitors' Day," the following papers were read and discussed: "Some Important Phases of Electrical Power for Steel Mills," by C. F. Scott, of the Westinghouse Electric and Manufacturing Company; "Motor and Control Apparatus for Steel Mills," by B. Wiley, of the same company; "A Steel-Mill Starter for Direct-Current Motors," by C. Pirtle, of the Electric Controller and Manufacing Company; "Allen-Bradley Controllers and Starters," by Lynde Bradley, of the American Fuse Company; "New Developments in Electric Apparatus," by Messrs. Rushmore, Pauly, and Whiting; "Leblanc Condenser," by Edwin Yawger, of the Westinghouse Machine Company.

June 25 was given up to visiting various large iron and steel works in Buffalo and vicinity, and the electric power plants at Niagara Falls. A brief meeting was also held on this day.

The next convention will be held at Pittsburg at a date to be selected later.

Rome Telephone Company Sold.

The property of the Rome Home Telephone Company was sold by the bondholders on July 14 at foreclosure sale. The plant was built in 1900 from the proceeds of the sale of $150,000 of five per cent mortgage bonds.

The Cleveland Trust Company, of Cleveland, Ohio, was the trustee named in the mortgage for the bondholders. On the first of last October the telephone company failed to meet its interest payments, and after waiting three months, as the mortgage provides, the bondholders notified the trust company to proceed with the foreclosure of the mortgage.

At the sale the property was bid in by James S. Brailey, of Toledo, Ohio, acting for the bondholders, for $20,100. The plant will be rebuilt and the automatic system installed.

National District Heating Association.

Directly after the close of the Ohio Electric Light Association's convention a meeting was held at the Hotel Boody, Toledo, Ohio, July 15, for the purpose of forming an organization of central-station managers interested in district heating.

On motion of Mr. Gwynn, A. C. Rogers was elected temporary chairman and W. A. Wolls temporary secretary. Mr. Rogers, on taking the chair, stated the general objects of the meeting to be the formation of an organization of central-station men interested in district heating.

After general discussion whether the organization should be a state or national one, it was decided to form a national organization, under the name of the National District Heating Association, to be composed of active and associate members, the associate members to embrace members of all supply or material concerns that cater to the heating business.

The following officers were duly elected: President, A. C. Rogers, Cleveland, Ohio; vice-president, A. N. Cope, Springfield, Ohio, and secretary-treasurer, W. A. Wolls, Columbus, Ohio.

Committees were constituted as follows: Executive committee, E. F. Gwynn, chairman; membership committee, W. A. Wolls, chairman; finance committee, A. N. Cope, chairman, and programme committee, D. J. Hard, chairman.

The executive committee was instructed to prepare a constitution and by-laws, effective as of this date. The committee on programme was authorized to select suitable papers and topics to come up at the first annual meeting. The membership committee was authorized to obtain lists of all central stations now doing district heating and to solicit their membership. The annual dues were fixed at $5 for active members and $10 for associate members.

The place of the first annual meeting was fixed at Columbus, Ohio, to cover two days, upon dates in November, 1909, to be fixed hereafter by the executive committee and due notice thereof promulgated.

Iowa Court on Telephone Service.

A telephone decision denying arbitrary or even punitary powers to the company comes from the Iowa Supreme Court. The case was one where the company had taken out a telephone because of the too emphatic way a subscriber had expressed his opinion of "central's" attentiveness and because he had a habit of listening to conversations on the line.

An Anglo-American Student Exchange.

A scheme is on foot in England to provide an interchange of college students between Great Britain, Canada and the United States. Lord Strathcona is the president of the movement, and the list of vice-presidents includes the heads of many British universities, as well as the prime minister and many other distinguished people. One of the objects of the movement is to establish certain traveling scholarships for practical observation in other countries under suitable guidance, the selection to be made along the lines of the Rhodes scholarships. It is hoped to afford technical and industrial students facilities to examine into questions of particular interest to them in manufactures, etc., by observation in other countries and by providing them with introductions to leaders in industrial activity. It is proposed to establish two students' traveling bureaus, one in New York and one in London; to appoint an American secretary (resident in New York) and a British secretary (resident in London), to afford every facility to any graduate who wishes to visit the United States, Canada or Great Britain for the purpose of obtaining an insight into the life of those countries. It is hoped to provide twenty-eight traveling scholarships, fourteen of these being available for universities in the United Kingdom, ten for universities in America and four for universities in Canada. The total cost of the scheme, inclusive of the maintenance of traveling bureaus and the provision of twenty-eight scholarships per annum, is estimated at $67,500 for a period of three years, equivalent to an annual expenditure of $22,500, the relative annual expenditure being estimated at $12,000 in the United Kingdom, $3,000 in Canada and $7,500 in the United States.

Government Wireless Station on a Private Estate.

The United States government has obtained permission from Catholina Lambert, the silk manufacturer, to establish a wireless station on the observatory above his picturesque home on Garret Mountain, New Jersey. This will be the highest of a number of stations to be established near the Atlantic coast.

It is about 1,000 feet above sea level, and in a direct line about fourteen miles from the ocean. The War Department has always realized the value of Garret Mountain as a vantage point for a wireless station in case of war.

CENTRAL STATIONS IN TOWNS OF LESS THAN 4,000 POPULATION.[1]

BY JAMES S. KNOWLSON.

As a class, the central stations in towns of less than 4,000 people, while representing over sixty-five per cent of the total number of central stations in the country, receive but scant attention from the engineering fraternity. The problems which they must solve in order to prove a financial success are not discussed with anywhere near the same fullness of detail as are those of the large stations.

The primary object of a paper on such a subject must be to voice the need of co-operation among small-station managers for a broader and more analytical discussion of their problems, and its secondary object should be to outline briefly the factors that must be given weight in the design of such stations, to touch on those policies that have helped to make some of them good financial propositions and, perhaps, in passing, to suggest some methods of increasing business.

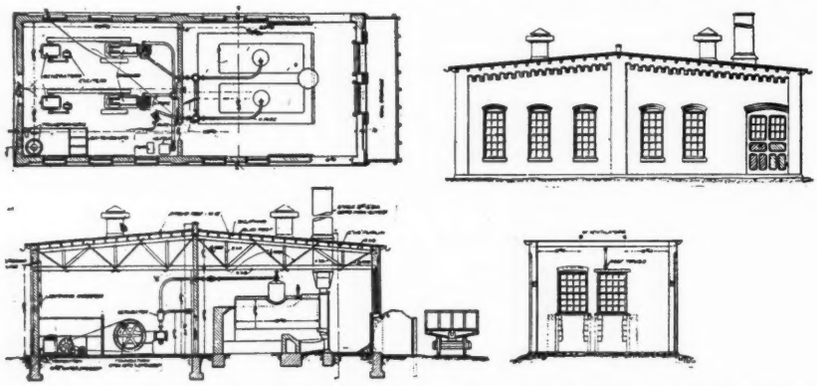


FIG. 1.—ARRANGEMENT OF 100-KILOWATT, 2,300-VOLT, 3-PHASE, 60-CYCLE, ALTERNATING-CURRENT GENERATING STATION.

The smaller central station rarely owes its inception to outside capital. It is usually a direct answer to the demands of the people for those conveniences which modern existence has placed in the category of necessities. The central station may be considered in the same class with the police and fire departments; not primarily a commercial enterprise, but a local institution.

The ideal organization for a central-station company in such a community is one with a wide distribution of stock, with practically every consumer owning one or more shares, and with the best business men of the town as its executive officers. Such an organization gives all the advantages of a municipal plant, makes the company a matter of local pride and almost a public institution, and at the same time guarantees that it will receive the hearty co-operation of the people as a whole, and the attention which the best business men can give it.

Turning from the subject of company organization, the problems of location and equipment demand first consideration.[1] In all discussions as to the requirements of such stations two facts must be kept constantly in mind. First, that the amount of available capital is always very limited; that $100 frequently means one per cent of the entire first cost of the plant. Second, that the equipment must be extremely simple; that it must not be such as to demand expert care, and while many refinements may, on paper, show a fuel economy sufficient to warrant their use, the additional apparatus necessary so complicates the operation of the plant as to raise materially the standard of attendance necessary and adds to the maintenance cost and chances of trouble.

Location.—The station should be situated as near to the railroad or local point of fuel supply as possible. It should also, if possible, have available a water supply free from lime or other solid material in suspension or solution, and of such quantity as to make condensing feasible. For even though the station will probably start non-condensing, the natural growth will in time raise it to a size where it will pay to condense. Enough ground should be obtained to provide space for extensions, for storeroom and for stables.

Layout.—Fortunately, or unfortunately, the small-station engineer seldom has to worry about limited floor space. Land is cheap. The result has been in such stations that we find very little consideration given to compact arrangement, and buildings, as a rule, are far larger than is necessary and often extremely inconvenient.

The power-house arrangement for such a station should combine three qualities: simplicity, convenience for operating purposes, and susceptibility to economic extension; which last means a parallel boiler and engine room. Fig. 1 shows an ideal layout for a small central station of 100 kilowatts capacity, using simple non-condensing high-speed engines belted to fifty-kilowatt generators.

In such a station the engineer will have as a fireman a rather unreliable helper, and at times he will probably act as fireman himself. With an arrangement as shown here, the engineer may stand in front of his switchboard, and from that position be in full view of the gauges on the end of the boiler, and from the boiler room he may still be in full view of his switchboard. Ample space is allowed on all sides of the generating apparatus, rendering it easily accessibile. The steam piping is of the most economical length and interconnected, permitting the utmost flexibility, and the auxiliary apparatus, heater and boiler-feed pump are conveniently located.

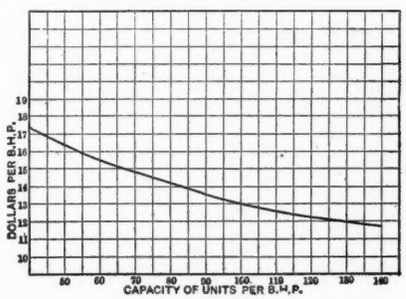


FIG. 2.—AVERAGE COST PER BRAKE-HORSEPOWER OF HORIZONTAL RETURN-TUBE BOILERS, INCLUDING SETTINGS.

In the boiler room sufficient space is allowed for cleaning boilers, and coal storage is taken care of in a most simple manner. The coal is unloaded from cars into a bin at the end of the boiler room, and is fed automatically to the firing floor through an opening in the base of the building, or may be wheeled in through the large doors at either end, which also permit a ready exit for ashes. With such an arrangement the natural extension will cause the boiler and engine room to grow side by side.

Apparatus.—In stations of the capacity under consideration, return-tubular boilers are generally installed; for, while water-tube boilers are capable of better economies, the efficiency of a boiler plant

[1] Abstract of a paper read before the technical session of the National Electric Light Association at the annual convention, Atlantic City, N. J., on June 3, 1909.

[1] This paper deals only with the station using steam boilers and engines.

rests heavily upon the methods of firing, and higher first cost of water-tube boilers seldom pays for their use in such stations. Fig. 2 shows the average first cost of horizontal return-tubular boilers in dollars per boiler-horsepower. This figure includes settings, but does not include stack or auxiliary apparatus. The price of water-tube boilers varies so radically that no general figures can be given, but their first cost is always materially higher than that of the return-tubular type. While the first cost of an iron stack is materially less than that of a brick stack, the upkeep is much greater. What this upkeep will be, and what length of life may be expected with an iron stack, are factors largely governed by local conditions, the humidity of the atmosphere, and the like. But even with a comparatively short life and high maintenance charge, the iron stack commends itself in the case of the small plant, because it

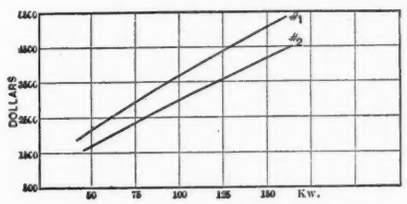


FIG. 3.—CURVE NO. 1.—COST OF HIGH-SPEED SIMPLE ENGINES AND DIRECT-CONNECTED GENERATORS. CURVE NO. 2.—COST OF HIGH-SPEED SIMPLE ENGINES AND BELTED GENERATORS.

may be so cheaply replaced by a larger stack to take care of increased station capacity.

In the engine room, the problem of whether the station shall be operated condensing or non-condensing must first be

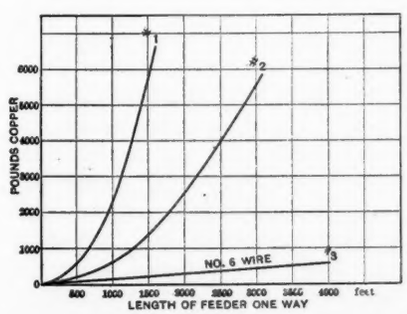


FIG. 4.—25-KILOWATT CAPACITY OF FEEDER, 10 PER CENT VOLTAGE DROP. CURVE NO. 1.—DIRECT CURRENT, 110 VOLTS. CURVE NO. 2.—DIRECT CURRENT, 220 VOLTS. CURVE NO. 3.—ALTERNATING CURRENT, 2,300 VOLTS.

discussed. The decision rests largely on the capacity of the station, nature of the load, price of fuel, and the availability of water; all these are local conditions, but it is generally true that in small stations it seldom pays to condense on account of the increased complications in operation.

Assuming that the plant will operate non-condensing, turbines or simple high-

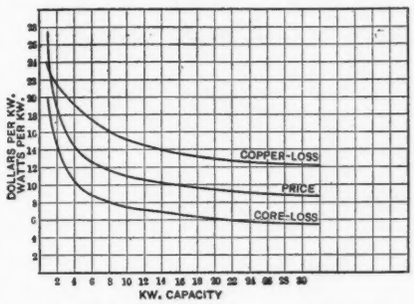


FIG. 5.—COMPARISON OF TRANSFORMER PRICES, CORE AND COPPER LOSSES PER KILOWATT FOR DIFFERENT CAPACITY UNITS OF 60 CYCLES, 2,300/220/110 VOLTS, OIL-COOLED POLE-TYPE TRANSFORMERS.

speed engines, either direct-connected or belted to generators, are to be recommended. A simple Corliss type engine, while showing much better economies at full load, is seldom as efficient on light loads as a high-speed engine, and, further, its first cost with the necessary foundations and jack shafting is far greater than that of the high-speed engine.

From an engineering standpoint, direct-connected apparatus should always be used; but it must be remembered that floor space is not an item, that in small-capacity units belt troubles and belt losses are not such serious factors as in larger sets, and that the item of first cost favors belted apparatus. Fig. 3 shows the relative first cost between direct and belted sets, using high-speed simple engines. Turbines, comparing favorably with direct-connected sets, are to be recommended on the score of better continued efficiency, and also on account of the fact that the exhaust is free from oil and may be used directly for other purposes.

It hardly seems necessary to say that the generators for such a plant should be alternating-current, sixty-cycle, polyphase machines. The average small station is located in a community loosely knit, with residences straggling out for a considerable distance, and a glance at Fig. 4 shows the large amount of copper which it is necessary to use in a twenty-five-kilowatt feeder circuit, in order to obtain a satisfactory distribution for 220 or 110-volt direct current, as compared with the amount necessary for 2,300-volt alternating current. However, if the greater portion of the load is in the immediate vicinity of the central station, alternating current may be generated at 220 volts and distributed on a three-wire system with 125 volts between the outer and neutral, and transformers may be used for stepping up this voltage in order to serve outlying districts economically.

The switchboard in such a station must be of the simplest type. Cheap boards are always poor economy, but complicated arrangements are unnecessary. The design of the board and its equipment depend entirely upon the kind of service rendered. For example, a station with a single generator carrying a street and commercial lighting load requires a single panel, carrying on its upper section instruments for commercial and street-lighting circuits and switches for the control of the series street lighting. On the lower section it carries a field rheostat and an oil switch that throws the generator directly on the commercial lines, this switch being made automatic as a protection to the generating apparatus. Such a panel combines all the functions required in such stations with low first cost. Any increase in the size of the station necessitates a corresponding increase in the equipment of the switchboard.

TABLE I.—POLE-LINE COSTS PER MILE FOR THREE-PHASE, 2,300 OR 6,000 VOLT.

No.	Item.	Omaha.	Kansas City.	Montana.	Minnesota.	Texas.	Tennessee.	Average.
50	30-foot poles	$275.00	$287.50	$200.00	$200.00	$171.00	$180.00	$218.90
50	Pole hardware	10.00	7.10	16.00	12.50	8.30	7.40	10.25
50	Cross-arms, 2-pin	17.50	7.25	11.50	15.00	17.00	16.00	14.00
150	Insulators	16.50	6.00	11.20	6.00	6.75	7.00	9.00
	Labor setting	80.00	90.00	200.00	125.00	55.00	100.00	109.00
	Labor stringing wire	25.00	15.00	40.00	50.00	30.00	40.00	35.00
	Incidentals	25.00	41.00	50.00	30.00	10.00	20.00	30.00
	Total	$449.00	$453.85	$528.70	$438.50	$297.05	$370.40	$426.15

These figures do not include painting and are exclusive of bookkeeping, overhead charges and the like.

Distribution.—Outside the central station, the largest single item of first cost is the pole line. This item depends so largely on local conditions, such as price of labor, quality of soil, and cost of poles, that it is difficult to make any general estimate as to the first cost. Table I, however, shows estimates for such pole lines in six different localities. Painting is not included in these estimates, but will range from twenty-five cents to $1 per pole, depending, of course, upon the locality.

It will seldom be necessary to use poles of more than thirty feet in length, and

as often twenty-five-foot poles may be used to advantage.

In arranging the secondary distribution every attempt should be made to install transformers in as large capacity units as possible. The saving per kilowatt in price, core and copper losses, which may be effected by using a single unit in place of several small ones, is shown in Fig. 5.

Street Lighting.—Until recently, street lighting has meant arc lighting. Today, however, while arc lamps unquestionably provide the best illumination in business districts and wherever they may be hung so as to allow for the proper distribution of their light, the series tungsten lamp is to be recommended for residential and suburban lighting where shade trees prevent the proper hanging of arc lamps, or where a large quantity of light is neither wanted nor required. Table II shows the first cost and operating expense of magnetite arc lamps and series tungsten lamps in various capacity units. It also shows the number of incandescent units necessary to provide the same street illumination as one arc. Arcs and series tungsten lamps may be operated on the same circuit, and the combination of a few arcs with a relatively large number of incandescents will probably provide the most satisfactory street illumination in the average small town.

Passing from the construction and design of the new central station, we approach the questions of operation and the methods whereby the greatest possible returns may be obtained on the invested capital. The consideration of this question naturally divides itself under four heads: Economies and improvements in operating conditions; addition of new business; broadening the scope of the plant; and the extension of service to outlying communities.

Economies and Improvements in Operating Conditions.—There are two points which are to be strongly emphasized. First, the necessity of keeping records that will show the cost of production; not complicated records, but adequate records. To the progressive central-station manager such a statement seems trite, but there are many plants that possess but the sketchiest sort of books. There is no station so small that it should not possess means of telling exactly how much its power costs. Every station should possess a recording wattmeter, measuring the total output; should record the fuel, water, supplies, labor and incidentals, month by month, and should keep this record in such form that it may be easily compared. The second point to be emphasized is that in attempting to improve operating conditions a definite programme should be followed. The station manager should experiment, by all means, but his experiments should follow along predetermined lines.

Briefly, then, regular inspections should be a part of the day's work. In the boiler room, the repairing of boiler settings and improvements in methods of firing will often bring phenomenal results. Dirty boilers and defective settings are among the greatest sources of loss and inefficiency possible. Boilers should always be operated at full or overload, if possible, and experiments should be carried on varying the number of boiler units for various portions of the load. Experiments should also be made with various qualities and types of fuels, and the results tabulated. In almost every community there are industries such as sawmills, jute mills, cotton gins, and the like, having a by-product that may be utilized as fuel to the mutual advantage of the manufacturer and the central station. In the engine room the engine should be frequently indicated, the valves set, belts and piping kept tight. In the distributing system, the rearrangement of transformers and the substitution of a single unit for several small ones will often show marked improvements. If a series incandescent system is used, the substitution of tungsten for carbon lamps should be made.

Addition of New Business.—There is a vast difference between getting business and taking business, and the live manager will go out and get it. If no electrical contractor or supply man is available, the central station must go into the wiring and supply business itself, wiring customers' houses and every new building that is put up in the town. Concessions should be made on the first cost of wiring, the total cost being spread over a number of months, perhaps a year. On such a basis practically every house in the town can be wired. But in approaching the prospective customer with such a proposition, a concrete estimate of the cost should always be made. General terms should be avoided, and he should always be talked to in dollars and cents.

Simple advertising by one or more methods is well worth while. Manufacturing companies are always glad to supply pamphlets and interesting reading matter on electrical devices, free of charge, to the central station for distribution among its customers. The windows of the company's office should always be illuminated, even if everything else on the street is dark; and it is perhaps a good plan to make the walls and woodwork of the office a light color in order that they may show up brilliantly. In newspaper advertising, one of the best plans is to let the printed matter take the form of frank talks with the customers as to the cost of electricity, showing what a kilowatt-hour will do; how many lamps it will burn, what it will cook, and the like. One manager of a progressive central station in a town of 2,700 people prints a list of the average monthly bills of all of his customers once a year, so that others may see how cheaply their friends receive light. Probably the best advertisement is a continuous service to satisfied customers, but, if for any reason, service is interrupted, the management should take the earliest possible opportunity to explain the cause to the public without waiting for someone else to tell the story.

Twenty-four-Hour Service. — Within the last year the statement has been frequently made that any place which could support electric service of any kind will support a twenty-four-hour service. This is unquestionably true in almost every community. The operation of a plant

TABLE II.—COST OF STREET LIGHTING IN VARIOUS UNITS.

Unit.	Arc, Magnetite 4-Ampere.	Tungsten 40-Watt.	Tungsten 60-Watt.	Tungsten 100-Watt.	Tungsten 200-Watt.
No. of units giving street illumination equivalent to one arc	1	4	3.21	2.48	1.76
First cost per unit, including brackets, transformers, etc., on a basis of equipment necessary for illumination equivalent to 100 4-ampere magnetite arcs	$54.00	$10.96	$12.00	$11.60	$15.70

OPERATING COST, BASED ON 4,000 HOURS' BURNING PER YEAR.

Unit.	Magnetite 4-Ampere Arc.	Tungsten 40-Watt.	Tungsten 60-Watt.	Tungsten 100-Watt.	Tungsten 200-Watt.
Maintenance and renewals	$ 6.00	$ 3.60	$ 3.80	$ 4.20	$ 4.67
Interest, 5 per cent	2.70	.55	.68	.58	.80
Depreciation, 5 per cent	2.70	*.49	*.57	*.52	*.73
Current at 2 cents per kw.-h	27.50	4.00	6.00	10.00	20.00
Total per annum	$38.90	$ 8.64	$11.05	$15.30	$26.20

*Exclusive of cost of lamps.

These figures are exclusive of repairs on overhead equipment, inspection cost, clerical, storeroom costs and the like.

for twenty-four hours a day, while increasing the fuel and labor charges, does not materially increase the maintenance and overhead charges on the plant, or demand the investment of additional capital.

The general use of electricity is increasing so rapidly that arguments for using electric power, rather than small steam or gas-engine units, are constantly growing in number and strength. From figures obtained in five or six towns with a day circuit, it appears that for each horsepower of motor load carried on the lines the central station may expect the sale of approximately 750 kilowatt-hours per annum. This is, of course, a general figure based upon the average of small motors used in many different lines.

In soliciting a motor load, the same general injunction may be given as in the case of lighting. A concrete proposition in dollars and cents should always be made to the prospective customer. His present engine should be indicated and he should be shown how much his losses in belts and friction amount to, and a definite estimate made of what electric service would cost him to do the same work. It is often necessary to install the wiring and motors on a thirty or sixty-day free trial, to be purchased at the end of that period, if satisfactory.

The pumping of water, particularly if a tank or reservoir system is used, is always a very advantageous load and may be taken at low rates, as the water may be pumped at almost any time of the day or night when the load is light. Beyond the motor load, there is an ever-increasing demand for electrical conveniences in the home, and these, in themselves, form a day load generally paid for at lighting rates, which should not be overlooked. Motors for driving sewing machines, washing machines and pneumatic cleaning outfits, toasters, coffee pots, milk warmers, chafing-dishes, heating pads, electric flatirons, and the like, are each rather insignificant when considered individually, but together form a considerable total. Many stations have estimated that flatirons alone will bring a revenue of $7 to $10 each annually.

Broadening the Scope of the Plant.—To broaden the scope of the central station and incorporate under the same management all the public utilities of the community is, or should be, the ideal of every central-station manager. The station should provide light and power and, added to these, water, heat and ice. Water and ice are both desirable additions, particularly in the southern and southwestern sections, the greatest demand for these coming in the summer when the lighting load is smallest.

The advantage of adding an ice plant to the central-station equipment is only beginning to be thoroughly appreciated. The existing boiler capacity is in almost every case adequate. The engine-room and boiler-room force, if the plant offers a twenty-four-hour service, need not be increased, except for one extra man as an ice-maker during the summer.

Extension of Service to Outlying Communities.—Another method by which a central station may increase its load is along the lines of extending its service to outlying communities. For years the larger companies have been pushing out their lines to greater distances from the central station, profitably serving communities which in themselves are too small to support a central station. Outlying from almost every central station are communities that likewise might be served, which should be carefully investigated by the station manager.[1]

Conclusion.—The general impression, that a small central station cannot possibly be a sound financial proposition, is unquestionably erroneous. Table III shows the gross revenue per capita in a number of typical central stations, ranging from stations supplying electric light alone to those furnishing light, water, and ice. They are all prosperous, and their owners are well satisfied; but the rank and file of successful small stations do not advertise their success, and it is hard to persuade them that what they are doing can possibly be of interest to others. The failures, though comparatively few in number, are much better known, but investigations of the reasons that caused these failures show that there were generally two factors that mitigated against success: First, overcapitalization; and second, inefficient machinery.

It has been said that the hardest lesson which the station manager has to learn is the value of the scrap heap, and the small-station manager has perhaps been slower to learn this than the managers of larger plants. Machinery today is much cheaper, more efficient and more rugged than in the past. Its operation is far simpler and requires less expert care. The costs of production and maintenance are being lessened each day, and at the same time the demands for central-station service are constantly increasing.

TABLE III.—REVENUE CHART OF TYPICAL SMALL CENTRAL STATIONS.

Location.	Population.	Capital.	Revenue—Ice.	Revenue—Water.	Revenue—Electricity and Supplies.	Total per Capita.
New Jersey	4,000	$30,000 stock	.....	.....	$10,909.42	$2.60
Illinois	1,000	$12,000	.....	.....	2,900.00	2.90
Kentucky	1,800	$7,500 stock, $5,500 bonds	.....	.....	6,145.72	3.41
New York	1,300	$12,000 stock	.....	.....	5,504.16	4.25
Ohio	1,800	$20,000 stock	.....	.....	8,300.00	4.60
Illinois	2,000	$10,000	.....	.....	7,563.98	3.78
Illinois	2,700	$25,000 stock, $12,500 bonds	.....	$ 720	8,353.80	3.36
Indiana	860	$10,000	.....	320	3,952.00	5.00
Ohio	1,900	$40,000	.....	3,745	7,235.20	6.10
Kentucky	1,900	$40,000	$4,945.52	1,270	7,933.00	7.85
Iowa	4,000	.....	12,000.00	$5,600 steam heating	38,300.00	14.00

The Colorado Electric Light, Power and Railway Association.

The seventh annual convention of the Colorado Electric Light, Power and Railway Association will be held at Denver, Colo., October 7, 8 and 9, the same week as will be held the convention of the American Street and Interurban Railway Association, which is announced for October 4 to 8, inclusive, also at Denver. Thus those desirous of attending the two conventions can do so at the expense of a single trip to Denver.

The entertainment features of the two associations will be undertaken conjointly as far as possible. In this connection the Colorado association announces that no collection will be made this year from associate members to pay for the entertainments.

The following papers are to be read at the Colorado association's convention: "The Commercial Field," "Meters and Testing," "Lamps and Illumination."

During the week of October 4 to 8 there will be, so the announcement runs, "one gorgeous, stupendous, astounding meeting of the Rejuvenated Sons of Jove."

[1] This subject was treated by the author in a separate paper read before the Northwestern Electrical Association. It was abstracted at length in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 5, 1909, page 1046.

The Faraday Society.

The forty-fifth ordinary meeting of the Faraday Society was held on June 15, at the Institution of Electrical Engineers, London, England. Dr. N. T. M. Wilsmore occupied the chair.

E. R. Taylor, chairman of the conservation committee of the American Electrochemical Society, delivered an address, which was profusely illustrated with lantern slides, on "The National and International Conservation of Water for Power." The author pointed out that the waterpower capacity of the United States, with proper conservation, is not less than 150 million horsepower, without considering the storage capacity of brooks. Of the annual stream-flow, less than one per cent is restrained and utilized for municipal supply and such purposes, less than two per cent is used for irrigation, five per cent for navigation, and less than five per cent for the production of power. From eighty-five to ninety-five per cent is wasted in floods. This illustrates the kind of waste that is going on all over the world, and typical examples of such wasted resources were described and illustrated by the author, who strongly advocates the impounding of flood-waters in the uplands with its accompanying afforestation of the hills, and the simultaneous conservation of sources of power, which are vast in the aggregate, and which at present are almost entirely uncontrolled and untapped. The electrochemical industries in particular would benefit by the creation of cheap and abundant sources of power, on which their very existence depends. The lecturer strongly urged the necessity for this problem being considered internationally by all the civilized peoples of the world. A beginning will be made in 1910, when an international conference will be held at The Hague.

Walter Reid pointed out that the conservation of waterpower over large areas might be very difficult of accomplishment in England, where the value of land was so high, and where there was a large number of cities very close together. Others who discussed this subject were W. Murray Morrison, Dr. H. Borns and the chairman.

W. Fielding contributed a paper entitled "The Formation of Silicon Sulphide in the Desulphurization of Iron." In the refining of steel in the electric furnace a very complete desulphurization of the metal can be effected, and this action is facilitated by the addition of a charge of ferro silicon. Several explanations have been put forward to account for this influence on the removal of sulphur. The object of the author was to investigate the conditions under which ferro silicon can react with ferrous sulphide, and liberate a sulphide of silicon, and the reaction of the two compounds was investigated by heating intimate mixtures of them in a vacuum at known temperatures. The heating was effected in a crucible in the form of a hollow graphite rod, heated electrically. When the commercial variety of iron sulphide was used, the mass fused at a temperature of about 930 degrees centigrade, and a vigorous reaction set in with rise of temperature. Using pure iron sulphide (free from oxide) no reaction was observed up to about 1,300 degrees centigrade, hence the reaction noted in the first case was probably due to reduction of oxide of iron present by the ferro silicon. This explains the sudden rise of temperature noted. In all the experiments a yellow sublimate began to appear on the walls of the tube at a temperature of 1,500 degrees centigrade. This was found to consist of approximately fifty per cent silicon sulphide, the remainder being iron sulphide, which had volatilized, silica, and a small amount of ferric oxide in a finely divided state.

Prof. A. K. Huntington, F. E. Pollard and the chairman discussed the paper briefly.

"A Contribution to the Study of Electric Furnaces as Applied to the Manufacture of Iron and Steel" was communicated by Charles A. Keller. The author states as his opinion that the electrical production of steel in electrode furnaces necessitates their being fitted with hearths of a conducting material that will not carbonize the metal produced. Conducting hearths at present in use are mostly made of a layer of agglomerate carbon or of a bundle of electrodes. The upper electrode, being kept in the slag, will not operate as a carbonizing agent. The author described the various classes of conducting hearths, classifying them as follows: (a) Those made entirely of metal, water-cooled. These have no industrial value. (b) Those consisting of one or more metallic poles (or graphite protected by metal) embedded in non-carbonizing masonry. The original furnace of Siemens and furnaces by Borchers and Girod are of this type. (c) Those consisting of a hearth of refractory material, such as magnesia or silica, rendered conducting by a carboniferous substance. (d) Furnaces with a hearth made up of a mixed conducting material; this is the type devised by the author. The hearth consists of "reinforced clay," made up of iron bars, placed vertically and packed solid with magnesia. When cold, only the bars are conducting, but when in operation the hearth is conductive over its whole section, and the electrical resistance is very small. The author states that the bottom of the furnace is absolutely indeformable. The hearth of a 1,500-kilogramme furnace, examined after many months' service, was in exactly the same condition as when it started. The author has made a comparative study of the more usual type of furnace, with vertical electrodes in series, serving as entrance and exit for the current, and the furnace with conducting hearth, and he concludes that the latter has metallurgical advantages over the former for furnaces of moderate size, since the current traverses the whole mass of metal, and thus renders it more homogeneous. Moreover, the furnace is very simple mechanically. On the other hand, the series electrode furnace is of simpler construction, and only half the current density is necessary for the same output, thus economizing electrical connections. The furnace with conducting hearth will need careful design to minimize the self-induction and increase the power-factor, and a low frequency, say, about twenty, should be employed. With this frequency, a power-factor of 0.9 should be attained with a 1,000-kilowatt furnace. The remainder of the paper describes in detail the construction and performance of the various furnaces the author has erected. These furnaces are furnished with vertical electrodes both for the entry and exit of the current, and they are characterized by the separate regulation of the two fires created by each electrode. The most important example is the eight to ten furnace in operation at the Holtzer Steel Works at Unieux. This is in reality two superimposed electric furnaces, of which the upper is used for melting and oxidizing the billets of iron and steel, and the second for purifying the molten steel. The Holtzer furnace has four movable electrodes, each pole consisting of two electrodes, which can be regulated so as to alter the voltage or current by displacing either or both pairs. This method of central distribution of current results in very small self-induction; the power-factor is 0.97 when 12,000 amperes are passing. A detailed account is given of the performances of this furnace, which can purify the steel until the phosphorus and sul-

phur together only total 0.01 per cent. A brief consideration of a three-phase furnace, with electrodes connected either in mesh or star, concludes the paper. The author is of opinion that a twenty-ton three-phase furnace, of about 1,800 kilowatts, could now be constructed. Such a furnace could purify 250 to 300 tons of steel per day, obtained from a Thomas converter, at an operating cost of fifteen to twenty francs per ton, with electricity at 0.15d. a unit, such as would be obtainable by utilizing blast-furnace gas.

J. Harden considered a water-cooled electrode beneath a furnace hearth far too dangerous an arrangement to be generally adopted. He thought electrode furnaces would be of limited application on account of the difficulty of procuring electrodes. The variations of power, thirty to thirty-five per cent, in these furnaces were very great. E. Ristori, W. Murray Morrison and Mr. Cobb, all agreed with the last speaker in his criticism of the water-cooled bottom electrode.

Gustave Gin communicated a paper entitled "Automatically Circulating Furnaces of the Gin Type for the Electrical Production of Steel." The paper describes induction furnaces in which the molten material is in continual circulation, such as described in his article in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 26, 1909, page 1183.

The forty-sixth ordinary meeting of the Faraday Society was held on Tuesday, June 29, 1909, at the Institution of Electrical Engineers, 92 Victoria Street, London, S. W., Eng. Dr. N. T. M. Wilsmore occupied the chair.

Dr. Henry J. S. Sand read a paper entitled "Apparatus for the Rapid Electro-Analytical Separation of Metals."

The paper contains a description of some developments made in the apparatus, first described by the author about two years ago, for the rapid electro-analytical deposition and separation of metals.[1] This apparatus for the first time combined in a practical manner the use of an auxiliary electrode and very rapid stirring of the electrolyte, and made it possible, as has been shown so far, to deposit and separate from each other for purposes of chemical analysis the metals silver, mercury, copper, bismuth, lead, cadmium, zinc, antimony, and tin. The times required for these depositions varied in the majority of cases between five and fifteen minutes. Apart from the very high stirring efficiency of the electrodes, the apparatus is believed to be superior to others of similar type in the exceedingly great simplicity of the method of making and undoing the electrical connections on a single stand, in the fact that the electrodes may be used with ordinary beakers, and in the simple manner in which the electrodes may be washed and dried. No alterations in principle have therefore been made to the apparatus, but the following additions and simplifications are described:

As hitherto, a mercury contact has been employed in the electrolytic stand to make the connection between the stationary and the moving parts; a special screw cap has, however, now been provided, which may be screwed down when the apparatus is not in use, making it possible to transport it without taking out the mercury.

A clutch arrangement has been added which enables the operator to start or stop the rotation of the anode without stopping the motor. Such an arrangement will be found of advantage if it is desired to actuate several sets of apparatus from one shaft driven by a single motor; or if the current is obtained from a small motor-generator which is also employed for rotating the electrode, the clutch making it possible to stop or start the stirrer without stopping the current; or, lastly, if a hot-air or water motor is employed which cannot be stopped instantly during the washing of the electrodes.

A very considerable simplification has been obtained by fitting all the apparatus required for the measurement of the potential of the electrode in a single box. The arrangement has been designed so that by depressing a key it will also allow the potential difference between the anode and the cathode to be read directly. It was thought very desirable to retain the capillary electrometer as a zero instrument, but it became necessary to design a new portable form suitable for the purpose in view. It may be described as a closed evacuated form developed from the Ostwald capillary electrometer. It is provided with an enclosed scale, and if observed by a lens of small magnification, it will readily indicate one millivolt.

Dr. B. Beckett Denison communicated a paper entitled "Researches on the Relative Rates of Migration of Ions in Aqueous Solution."

The author has determined, by the method of direct observation of moving ionic boundaries, the transport numbers of the halide salts of the metals of the alkalies and alkaline earths. The concentrations of the solutions were 0.1 to 0.02 normal. It is pointed out that the study of transport numbers by the direct and indirect methods has been shown to afford a means of determining the degree of hydration of the ions, although in the present paper none was calculated.

S. Field read in abstract a paper on "The Conditions which Determine the Composition of Electrodeposited Alloys. Part I. Copper-Zinc Alloys."

As the result of a large number of experiments on the electrolytic deposition of brass, the author has, by the analysis of the deposits, shown the regular manner in which the composition changes with such varying conditions as (1) proportion of copper and zinc compounds in the solution; (2) strength of the solution; (3) temperature; (4) current density, and (5) the presence of free cyanide. It is thus shown that the proportion of zinc is increased (a) at lower temperatures; (b) with more dilute solutions; (c) with increased current density, and (d) by the absence of free cyanide. With a large proportion of zinc compound copper is still freely deposited. The author incidentally draws attention to a number of important conditions which primarily affect the composition of the solution and ultimately the character and composition of the deposit.

[1] Chemical Society Transactions, Vol. 91, p. 373 (1907); Vol. 93, p. 1572 (1908).

Discriminates Between Bulk and Retail Service.

The report of the Massachusetts State Gas and Electric Light Commission with its decision on the appeal of the Fitchburg Gas and Electric Light Company, from the orders of the board of mayor and aldermen granting the Connecticut River Transmission Company the right to erect and maintain poles and wires for the transmission of electricity in Fitchburg, has been filed and confines the new company to customers using 300 or more electrical horsepower.

The decision gives the Connecticut company the right to sell electricity to the Fitchburg Gas and Electric Light Company and the Fitchburg & Leominster Street Railway Company but does not allow it to sell to any other company or individual to be resold, and declares that the Connecticut company and the local company are not natural competitors and expresses doubt over the ability of the latter company to supply large users and equal doubt over the ability of the former to profitably supply large and small consumers on the same terms.

Chicago Electric Club.

Following the regular Wednesday noon luncheon of the Chicago Electric Club, on July 14, in the grill room of the Chicago Automobile Club, the members were entertained by an excellent address on the "Ethics of Salesmanship," by H. P. Albaugh, of the mail-order house of Albaugh-Dover Company, Chicago. In the course of his address, Mr. Albaugh commented on the light in which the profession of salesmanship is being looked at today, which was by no means complimentary. This, to a great extent, according to Mr. Albaugh, is due to the salesman who is after a swollen record of orders, and the speaker used an amusing story to describe his opinion of the "near salesman," who, by misrepresentation, bluffing, etc., attempted to attain that end. In concluding, Mr. Albaugh mentioned the three essential qualifications which, in his opinion, were necessary in every salesman, namely, originality, enthusiasm and the power to control other people's minds.

The chairman of the entertainment committee, John J. Schayer, after giving a brief review of the programme for the picnic on July 17, announced that the delay in distributing the tickets was due to the final arrangements with the Casino, at Michigan City, over the serving of dinner. A large attendance was expected.

The first annual outing of the Chicago Electric Club, which was held at Michigan City, Ind., on Saturday, July 17, was a success from every viewpoint. Nearly two hundred members and guests left the Clark Street bridge at 10 a. m. on the steamer Theodore Roosevelt. Dinner was served at Michigan City at 12:30, and shortly after dinner there was an exciting baseball game. This was followed by a race for fat men, which was won by the jovial and agile Porter. The thin man's event went to Phil Fisher. The swimming race was the event of the day, and was cleverly won by J. F. Holland.

A delightful supper was served early in the evening and the party embarked at 7:45, occupying the greater portion of the upper forward deck, where all the old songs were rendered by a fine chorus made up of members and friends. During the return trip three times three cheers and a tiger were given for J. J. Schayer, chairman of the entertainment committee, and for C. A. S. Howlett, president of the club, with whom the idea of the picnic originated.

Annual Convention of the American Society of Civil Engineers.

The American Society of Civil Engineers held its forty-first annual convention at the Mount Washington Hotel, Bretton Woods, N. H., July 6 to 9.

The Tuesday session was opened by Onward Bates, who delivered his presidential address on "The Status of the Civil Engineer's Profession in the United States." President Bates accepted Thomas Tredgold's historic definition of a civil engineer as the best that could be offered, although, he said, the civil engineer's duties had, since Tredgold's time, become so enlarged, diversified and multiplied that it would seem impossible to state in words what may be reasonably expected of a civil engineer at the present time. An analysis of the 2,380 members of the society (February, 1909) showed that about twenty per cent were in government service, fifteen per cent employed on railroads, eighteen per cent in manufacturing or contracting, five per cent consisted of architects, professors, etc., and twenty-one per cent were unclassified. He deprecated strongly the civil engineer's professional narrowness which often made him the servant where he should be the organizer or director, and suggested as a remedy that the civil engineer should become more of a mixer and assume the initiative where he was wont to be a follower. It was not unprofessional for an engineer to be a capitalist, and at any rate he should tend to create a sentiment for an equitable remuneration of his services. Finally, an engineer's rating of competency should be established by the opinions of his fellow engineers, and to this end all civil engineers should strive to increase their acquaintance in the profession, and should desire the honor and responsibility of membership in the society.

Among the reports and topics which were presented for discussion were the following: "The Status of the Metric System;" "Report of the Special Committee on Concrete and Reinforced Concrete," which gave rise to a lively discussion; "Fire Resistant Construction in Buildings;" "Impurities in Sand for Concrete;" "Road Watering as Compared with Oiling for Laying Dust."

The convention proved thoroughly enjoyable in every respect, except perhaps in the paucity of the technical proceedings, which possibly accounted for the regrettably small attendance.

The date and place of the next meeting were left to the board of directors. The Isthmus of Panama was mentioned in this connection, although it was proposed by F. P. Stearns to delay such a trip until 1911, when the canal work would be in full swing.

Electrification Plans in Germany.

It would seem that the Germans are planning some big projects for the electrification of their railroads in the near future. Herr Wilhelm Wechmann, chief electrical and mechanical engineer of the Prussian Royal Railways, has been for several weeks past inspecting the latest types of single-phase roads on the Pacific coast. In a recent interview he stated that the Prussian government intends to electrify 280 miles of steam railroads, and that it has practically decided on 10,000-volt, fifteen-cycle, single-phase, alternating current, with catenary overhead construction. The tentative plans, according to Herr Wechmann, call for an outlay of about $40,000,000.

Briquette Making.

In connection with the announcement in our last issue of the publication of Bulletin 385 of the Technologic Branch of the United States Geologic Survey, on "Briquetting Tests," a short abstract of a paper on "Briquette Making," recently read before the South Wales Institute of Engineers, by Prof. W. Galloway, will prove of interest as showing the progress of this industry in Europe.

The burning of small coal under boilers is made much more economical when the coal is used in the form of briquettes. It is advisable, in briquetting anthracite, to mix with this coal a certain proportion of bituminous coal to accelerate the rate of burning. The most satisfactory agglomerating material tried up to the present is pitch or resin, or a mixture of these, the best results being given by a mixture of slack coal with a binder of four per cent of pitch and one-and-one-half per cent of resin.

The total output of briquettes in the United Kingdom in 1906 amounted to 1,513,220 long tons, and in Germany to 14,500,851 long tons in the same year.

The paper contains full descriptions and drawings of the mixing and drying machinery and presses required for briquette making, together with estimates of labor required and costs. For example, at an English works making a little over 100 tons of briquettes per day of ten hours, the total cost, including labor, materials, fuel and stores, interest and depreciation, works out to $2.32 per long ton.

The Preservation of Poles.[1]

There are about 40,000,000 poles in use in the United States, by telegraph, telephone and other companies, valued at $5 to $7 each on an average, or a total of $200,000,000 to $280,000,000. It requires about 3,800,000 poles each year to replace those that have become useless from decay. The average life of white cedar and chestnut poles in the United States, other than the Gulf States, is about twelve years. Hence, the depreciation is about eight-and-one-half per cent per year, or $17,000,000.

The subject of the preservation of timber has engaged the attention of scientists and engineers for over a hundred years.

In 1884, Mr. Boulton, an eminent engineer of England, read a paper before the Royal Society, in which he reviewed all the known methods of treating timber antiseptically. All the different chemicals now in use to preserve poles were well known then. This paper of Mr. Boulton, together with the discussions, was printed in book form. It constitutes today a classic on the antiseptic treatment of timber. Yet, at that time the real cause of the decay of timber, fungi, was known to probably not more than a dozen in the convention.

It is now a well-established fact that the cause of the decay of poles at the ground line is a fungous growth. Furthermore, it is known that this growth attacks the pole from the outside and not the inside, except, of course, in cases of butt rot.

Although various methods of impregnating timber with chemicals have been known and used with some variations, for sixty years, it is estimated that less than ten per cent of the poles in use in the United States have been treated by any method.

Mr. Boulton in his paper established that a material used to preserve poles by any of the methods then used must have two properties: (1) It must be a germicide; (2) it must be a germ excluder.

The great effort of all experimenters and scientists from that day to this has been to get some chemical, or combination of chemicals, which, when injected in the form of a solution, would become immediately insoluble; one that would not wash, leach, or soak out, but would remain in the timber indefinitely and kill the germs therein, and prevent other germs from entering. Science has so far failed to find this substance.

It is a popular notion that deep penetration of germicides is necessary effectively to preserve timber or poles. This is not true. The wood-destroying germs begin their ravages on the outside and work toward the center of the pole. It follows, then, that if the germs on and near the surface of the pole at the ground line can be destroyed, and the myriads of germs in the air and in the soil surrounding the pole can be excluded, the pole will be preserved. The only advantage there is in deep penetration when using the old methods is that it requires a longer time for the germicides to be leached or washed out.

The practical requirements of any succesful method of preserving poles must have the following advantages: (1) It must be a method that can be used by large or small companies having a large or small number of poles to treat. (2) It must be capable of being applied to new, or partially destroyed, poles in the ground. (3) It must not require a large or expensive plant. (4) It must not require highly skilled labor. (5) It must not require the transportation of poles to and from the plant. (6) It must not require more than one treatment, and must be positive and effective, and relatively inexpensive.

When the company[1] with which the author is connected began experimenting over nine years ago with its present method, the following facts had been established by scientists and experimenters: That poles commence to decay at, or about, the ground line; that the cause of this decay is a fungous growth, or living germ; that when this germ is killed the decay ceases; that many chemicals will kill these wood-destroying germs. It was also known that germicides in solution held in contact with wood, will be taken up into the pores of the wood by capillary attraction and the osmotic forces.

The aim of the experimentation was not to secure a chemical that was both a germicide and a germ excluder, but to use one or more of the well-known germicides and endeavor to exclude the germs in the air and soil, mechanically.

As most germicides which are cheap enough and powerful enough to be used in preserving poles are soluble, the mechanical device must serve the following purposes: It must exclude the germ after the pole is treated and at the same time retain and protect the chemicals in constant contact with the pole at the ground line; it must also prevent the chemicals from being taken up and absorbed by the surrounding soil.

The method adopted is first to dig down around the pole a distance of about fourteen inches from the ground line, and clean off any decayed wood from the surface of the pole. A layer of Portland cement mixed with sand is then placed around the pole at the bottom of the excavation. Next, a "hydrobestos" jacket is placed around the pole and one to two inches therefrom, imbedding the lower edge of it in the cement. The two edges of the jacket are lapped from one to two inches and fastened with a specially prepared cement and tacked upon a lath inside the jacket. The space between the pole and the jacket is filled with germicides in a dry state, mixed with sand. Around the top of the jacket is formed a reinforced cap or collar of Portland cement, imbedded in which are one or more wires around the pole. The collar protects the chemicals and jacket from the action of the rain and snow, and, if along steam railroads, protects the pole against the numerous grass fires. The chemicals are slowly dissolved by the natural moisture in the pole, and they pass into the same by capillary attraction. As they cannot pass out into the surrounding ground they go into the pole, thus destroying all fungi and wood-destroying insects. Thus there is a continuous absorption of chemicals and a mechanical exclusion of germs.

The hydrobestos jacket used around the pole is a pure mineral, composed of specially prepared and purified asbestos and asphaltum. This material is subjected to a pressure of about 27,000 pounds per square inch in its manufacture and is a very important factor in the method. There is no animal or vegetable fiber in it and it is practically indestructible in the situation used. In some special locations the jacket may be made of cement.

The reinforced Portland cement cap is an important part of the protective device. It prevents the rain and snow from entering the receptacle, holds the germicides, and gives a stability and attractiveness to the pole.

The germicide used consists of hydrated lime and chloride of sodium, mixed with coarse sand and one-fourth to one pound of sulphate of copper (per pole), according to size and condition of the pole. These proportions may be varied

[1] Abstract of a paper by H. P. Folsom, presented before the twenty-eighth annual convention of the Association of Railway Telegraph Superintendents, at Detroit, June 23, 24 and 25.

[1] The Universal Post and Pole Preserving Company, Circleville, Ohio.

somewhat in the case of partially decayed poles, according to condition.

On small jobs the men work in gangs of three. One goes ahead and digs around and cleans the poles and the other two follow with a one-horse wagon or hand truck containing the chemicals (if the line of poles is along the road or on the streets of a city), and finish the treatment. Or the material may be distributed in small sacks to each pole from a hand car, if along a railroad.

One gang of men can treat from twenty to thirty twenty-five-foot poles per day. A much larger number of new poles can be treated in a day. The cost depends upon the accessibility of the poles and whether the materials are purchased in carload lots or not, and also the price of labor; but it may be said that the cost would be from seventy-five cents to a dollar per pole, including royalty for the patent on the process. Some very large poles worth from $50 to $75 have been treated at a cost of $1.50 up to as high as $2.50. Even this will pay, when the cost of removal and renewal of the pole is taken into consideration. These figures may be reduced on large contracts.

According to the Government experts, the open-tank treatment costs sixty-seven cents per pole, not including hauling.

So little attention has been paid by pole users in the past, to the question of the depreciation of their poles and their preservation, that many have not stopped to think or figure what the cost of treatment should be in order to be practicable.

Poles which were partially decayed when treated, after over nine years show no increase in the decay, and the protecting device is in good condition.

Electrification in Japan.

All railroads in Japan will be operated by electricity within a few years, according to S. Kondo, chief of the electrical department of the Japanese Department of Communication, who is en route home from a tour of Europe and the United States to study electric railways. He is quoted as saying:

"It will be a matter of a short time until all the railroads in Japan are operated by electricity, although the conversion of the main lines from steam to electricity is not immediately contemplated. The element of economy is the greatest consideration, and so far as it is possible to utilize waterpower in the operation of branch lines construction of plants for the operation of the roads will be begun immediately."

New Copyright Law.

A new copyright law, which went into effect on July 1 last, repeals the act approved June 18, 1874, under section 3 of which labels and prints have been registered in the United States Patent Office. The registration of labels and prints in the United States Patent Office, therefore, ceased with the issue of June 29, 1909. Applications for the registration of labels and prints will not be filed in the Patent Office after June 25, 1909, and any received after that date will be forwarded to the Register of Copyrights, Library of Congress.

Work Starts on New Westchester Road.

Work was begun on July 12 on the new electric line between New York and Port Chester, which will cost about $21,000,000. The start was made at New Rochelle by the Ferguson Contracting Company. The new line will be completed first from New Rochelle into New York, and will take two years to build. It is being built by the New York, Westchester & Boston Railroad, and will serve as a suburban passenger entrance to the subway and elevated lines.

Rockingham Power Company Sold.

Properties of the Rockingham Power Company, including hydroelectric power plant, railroads, machinery, etc., were sold by Commissioners W. H. Brown and W. A. Leland under order of the United States Court at Wadesboro, N. C., on July 14 and bought in by D. H. Thomas, representing bondholders of the company, who was the only bidder. The purchase price was $1,000,000, sale subject to confirmation of court. This concern controls one of the largest electric-development plants in the South, located at Blewett Falls, near Wadesboro. The company had issued $1,500,000 in bonds, and this amount has already been spent in development of power plant, and liens were filed in court at Wadesboro aggregating $150,000 for unpaid claims against the company. The trouble in this enterprise dates back to the failure two years ago of the Knickerbocker Trust Company, of New York, which was financing the enterprise. Later differences arose between Hugh McRae and the company of Wilmington, N. C., and other stockholders, which resulted in litigation, which culminated in the sale today. It is understood the next step will be completion of big plant by purchasers. The power generated will be used in Wadesboro and elsewhere in different industrial lines.

American Exposition in Berlin.

An exposition of American products will be held in Berlin, Germany, during the months of April, May and June, 1910. This American Exposition will be given in the well-known Exposition Palace, near the Zoological Garden, in the best and most frequented part of the German capital.

The exposition is intended to educate Europeans, and especially the German people, to the importance and excellence of American manufactured products, to strengthen the existing cordial relations and to stimulate trade between the two countries.

The exhibitors will be freed from the annoying incidentals usually attending an exhibition of this kind. The decorations for the exhibition booths, water, heat, light and janitor service, will be furnished by the exposition management. Exhibitors will be protected from loss of fire or theft by insurance. Exhibits will be entered into Germany free of customs duty. The Hamburg-American Line and the North German Lloyd have granted a reduction of twenty per cent in the freight charges on exhibits both ways. The rental for space is $4 per square foot, which includes the features referred to above, as well as storage for the packing of the material.

The Exposition Palace is a massive stone and steel structure erected in 1907 at a cost of $1,500,000. It has two connected buildings, of about equal size, and the combined floor space available for exhibits is about 110,000 square feet, or nearly twice that of Madison Square Garden, New York city.

The American headquarters for the exposition are in the Hudson Terminal Building, 50 Church Street, New York city. Max Vieweger is the American manager.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on July 27 for 5,000 feet cable, for delivery at Brooklyn, N. Y.; 5,000 feet lamp cord, for delivery at Portsmouth, N. H., and for 5,000 feet wire, for delivery at Norfolk, Va.

Bids will be opened on August 3 for miscellaneous push and foot buttons and other electrical supplies, and for miscellaneous weatherproof wire and cables, for delivery at Annapolis, Md.; also for seventy-two porcelain insulators and miscellaneous magnet wire, for delivery at Brooklyn, N. Y.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

DENVER GAS AND ELECTRIC.

The Denver Gas and Electric Company reports earnings for the month of June, 1909, and twelve months ended June 30, 1909, which compare as follows:

June:	1909.	1908.
Net earnings	$72,836	$59,473
Interest, coupons, etc.	34,841	32,001
Surplus	$37,995	$27,472
Twelve months ended June 30:	1909.	1908.
Gross earnings	$2,299,182	$2,062,326
Expenses	1,300,623	1,210,171
Net earnings	$ 998,559	$ 852,155
Interest, coupons, etc.	392,147	378,601
Surplus	$ 606,412	$ 473,554

An analysis of the gross earnings for the twelve months ended June 30, 1909, indicates the following percentages of revenues from the various departments: Gas, 36.3 per cent; electricity, 62.3 per cent, and Pintsch, etc., 1.4 per cent.

SYRACUSE LIGHTING COMPANY.

Authorization has been given by the New York Public Service Commission, Second District, to the Syracuse Lighting Company, to execute its mortgage or trust deed for $2,500,000, and to issue at once $143,000 par value bonds. The bonds are to be sold at not less than ninety-five.

The company asked permission to issue $207,000 bonds, but it appeared at the hearing that there remained unexpended $70,388, applicable to additions and betterments under the $1,000,000 debenture issues of May 27, 1907. This amount will now be used in addition to the $143,000, just authorized.

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 964,024	$ 915,339
Expenses	600,617	572,259
June net	$ 380,407	$ 343,080
Charges	232,322	230,883
June surplus	$ 131,085	$ 112,247
Six months gross	5,391,575	5,163,555
Expenses	3,431,199	3,367,509
Six months net	$1,960,376	$1,796,046
Charges	1,404,630	1,385,547
Six months surplus	$ 555,746	$ 410,499

CHICAGO RAILWAYS COMPANY.

The report of the Chicago Railways Company for the month of May, 1909, compares with that for the same period of last year as follows:

	May, 1909.	May, 1908.
Gross earnings	$1,055,160	$902,482
Expenses:		
Maintenance of way and struc.	$ 55,180	$ 41,015
Maintenance of equipment	59,500	67,677
Operation power plants	110,332	78,073
Operation cars	325,010	290,219
General expenses	124,619	103,959
Exp. inv. real estate	3,446	2,798
Taxes (estimated)	31,155	16,608
Total	$ 709,744	$600,352
Balance (actual)	345,416	302,129
Balance based 70% operation	316,548	270,744
Deduct int. 5% on valuation	176,437	137,625
Net income	$ 140,110	$133,118
City of Chicago, 55%	77,060	73,215
Chicago Railways Co., 45%	63,049	59,903

PENNSYLVANIA BELL TELEPHONE.

The Bell Telephone Company, of Pennsylvania, announces that the American Telephone and Telegraph Company will exchange one share of its stock for one-and-one-seventh shares of the stock of the Bell Telephone Company of Pennsylvania. The exchange is to be made on or before August 1.

Directors of the Bell Telephone of Pennsylvania have approved the proposed exchange and have recommended to stockholders that they accept the proposal.

The exchange is on a basis of seven shares of American Telephone and Telegraph Company stock for eight shares of Bell Telephone Company of Pennsylvania stock.

MASSACHUSETTS ELECTRIC SUBSIDIARIES TO INCREASE CAPITAL STOCK.

The Old Colony Street Railway has petitioned the Massachusetts Railroad Commission for authority to issue 4,042 shares of preferred stock at $115 per share. The Boston & Northern Street Railway has asked authority to issue 5,883 shares of preferred at $115 per share.

These applications are for the purpose of increasing working capital under the new law permitting the company to fix prices of new stock, subject to approval by the Commission.

AMERICAN LIGHT AND TRACTION COMPANY.

The American Light and Traction Company reports earnings for the month of June and for six and twelve months ended June 30, 1909, as follows:

	1909.	1908.
Earnings	$ 238,171	$ 189,835
Expenses	9,649	4,000
Net earnings	$ 228,522	$ 185,835
Six months ended June 30:		
Earnings	$1,546,979	$1,217,426
Expenses	53,787	24,000
Net earnings	$1,493,192	$1,193,426
Twelve months ended June 30:		
Earnings	$3,052,616	$2,535,819
Expenses	74,787	36,562
Net earnings	$2,977,829	$2,499,257

NEW YORK & NEW JERSEY TELEPHONE COMPANY.

The American Telephone and Telegraph Company is offering shareholders of the New York & New Jersey Telephone Company the privilege of exchanging their stock, share for share, for American Telephone stock. The right of exchange holds good until August 31, 1909. The negotiable receipts given in exchange for New York & New Jersey shares are convertible into Telephone stock on or before December 31, 1909.

The New York & New Jersey Telephone Company has always been ranked as a Bell subsidiary, although the American Telephone Company owns directly but eight-and-three-fourths per cent of the entire capital stock. It is understood that the New York Telephone Company is a large stockholder, so that control undoubtedly lies within the American Telephone system.

Public Utility Corporations Pay Enormous Sums to the City of Chicago.

During the past few days the Chicago Telephone Company and the Commonwealth Edison Company have both paid over to the city of Chicago its share of their gross receipts, in the case of the former company for the six months ended June 30, and of the latter for the year ended May 31, 1909.

The amount paid by the Chicago Telephone Company was $119,930.58. This represents three per cent of the gross receipts of the company for the period named, and was accompanied by a statement of the earnings of the company, signed by Angus S. Hibbard, second vice-president, and Charles E. Mosley, secretary, as follows:

Exchange earnings	$3,730,438.08
Toll earnings	274,540.59
Private line earnings	6,238.95
Miscellaneous revenue	9,862.87
Total	$4,021,080.49
Less uncollectable total bad debts charged off	27,077.02
Less amounts charged off subsequently paid	3,682.49
	$ 23,394.53
Total gross receipts	3,997,685.96
Three per cent of gross receipts	119,930.58

The payment made by the Commonwealth Edison Company amounted to $360,752.15. This amount is the share of the city in the gross receipts of the company for the period mentioned, and a comparison of these figures with last year's shows an enormous increase in the light and power business in the city during the past twelve months. As a matter of fact, the city at this time only gets $269,752.15 in cash because the Commonwealth Edison Company advanced it $100,000 the first of the year to help over a tight financial situation. Both companies report splendid development in their respective fields and consider the outlook for the future as good as could be desired.

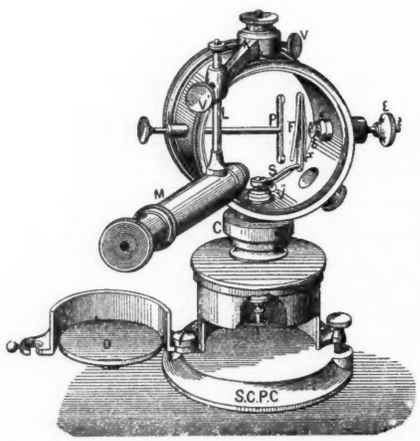
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

AN ENGINEERING SLIDE RULE.

A new slide-rule of special interest to engineers has been designed by James Lusk, of the firm of David Colville and Sons, Motherwell, Scotland, and is being marketed by D. Robertson & Company, of Glasgow. The rule differs from an ordinary slide-rule in that its logarithmic scales are arranged and graduated to suit engineering practice. The form of the piece of metal, the weight of which is to be calculated, may be rectangular, circular, or segmental, and may be of steel, wrought-iron, cast-iron, brass, copper, or any other metal. The only setting required for rectangular pieces is that of bringing the length and width opposite each other, and for circular pieces that of bringing the diameter on one scale opposite the diameter on another scale. For segmental pieces a scale is provided on which the distances are proportional to the logarithms of the areas of circular segments having certain ratios of height of segment to radius. Any desired percentage over and under the net weight in steel can be read as simply as the net weight, and this should prove especially useful to steelmakers, for example, in estimating the weight of slab required to roll a plate of given finished dimensions. The length of the rule, which is made in boxwood, faced with celluloid, is such as to give accuracy of the order of one-fifth of one per cent with a range of weights from 100 pounds up to twenty-five (long) tons.—*Abstracted from The Times (London), Engineering Supplement, July 7.*

APPARATUS FOR MEASURING RADIOACTIVITY BY THE ELECTROSCOPE METHOD.

C. Chaveneux and D. Laborde recently exhibited before the French Physical Society a very interesting apparatus, by means of which the radioactivity of any body—solid, gaseous or liquid—may be easily measured. When such bodies are in the field of a charged electroscope, the latter will be discharged on account of the conductivity imparted to the air by the radiations of the radioactive substance. The electroscope consists of a cylindrical metal case closed by glass plates, as shown in the accompanying illustration. It is screwed on a metal neck *C*, in which the resin insulator and holder *S* of the aluminum foil *F* are fastened. At the bottom the holder ends in a screw, to which points for the dispersion of the electrical charge may be attached. The aluminum foil is connected to the outside only by the insulated holder. It may be electrically charged by means of the rod *t*, which passes through the wall of the case and is insulated from the same by ebonite. The rod is movable in the direction of its axis and carries inside of the case a small eccentric metal plate *b*, which may be brought in contact with the foil in order to charge the same, and also with a projection *e* of the case, after the charge is completed. Influence phenomena induced by the charging arrangement are



ELECTROSCOPE FOR MEASURING RADIOACTIVITY.

thus avoided. The movements of the foil are observed through a microscope with ocular micrometer, which may be set in any position with respect to the electroscope, and provisions are made for fixing such position for the purpose of comparative measurements. During transport the aluminum foil is held firm by a metal piece *P* fastened to a rod movable from the outside. For the examination of solid bodies the electroscope is placed on a metal case and the rather short dispersion rod *T* projects into this case, on the bottom, *D*, of which the substances to be examined may be placed. For the examination of radioactive gases the electroscope is fastened to a closed copper cylinder containing the gases. In order to calibrate the apparatus a known quantity of emanation is introduced into the cylinder, and the loss of the charge measured three hours after the beginning of the emanation. The measurements of the apparatus are such that with a charge of about 300 volts, the saturation current is obtained within one to two per cent with the strongest practically measurable currents. The apparatus is, of course, also suitable for measuring induced radioactivity.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), June 6.*

TURBO-TANDEM ALTERNATOR GROUP OF 11,200 HORSEPOWER FOR THE BUENOS AIRES CENTRAL STATION.

In November, last year, Brown, Boveri and Company, of Mannheim, delivered to the central station of Buenos Aires the most powerful turbo-alternator group so far constructed. The turbine is to furnish normally 11,200 effective horsepower at 750 revolutions per minute. It is provided with a battery of surface condensers and is operated with steam superheated to 300 degrees centigrade under an effective pressure of twelve kilogrammes per square centimetre. For two hours it will carry a load of 14,200 horsepower. The normal steam consumption, with cooling water at fifteen degrees centigrade, and a load of 7,500 kilowatts, is guaranteed at 6.3 kilogrammes per kilowatt-hour. The turbine is directly coupled to two three-phase alternators in tandem, of a capacity of 7,500 kilowatts each. One of them furnishes a current of twenty-five periods and a combined tension of 12,000 to 13,000 volts, the other fifty periods per second and a combined tension of 12,500 volts. The directly connected exciter generates 100 kilowatts at 220 volts. The total surface of the condenser is 1,300 square metres. When fed by water at fifteen degrees centigrade it can condense 50,000 kilogrammes of steam per hour with a vacuum of ninety-five per cent; if the water is at a temperature of twenty-five degrees centigrade, a vacuum of ninety-one per cent can still be reached. The weight of the entire group, including the condenser, is 475 tons. On account of its great power and also in order to keep the steam consumption as low as possible, the turbine is divided into two cylinders

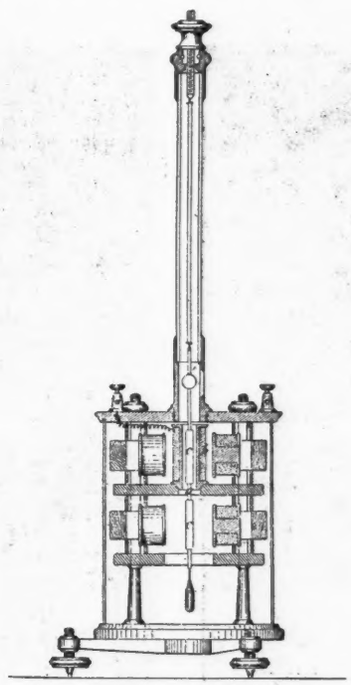
with an intermediate bearing. The dynamos are of the usual type of turbo-alternators manufactured by Brown, Boveri and Company, with rotating inductor and stationary secondary. They can easily withstand an overload of twenty-five per cent for half an hour. The maximum temperature after a continuous run of ten hours is not to be more than forty-five to fifty degrees centigrade above that of the surrounding atmosphere. The six alternators of this type intended for the Grand Central Station of Buenos Aires are all to be supplied by Brown, Boveri and Company, as well as three of the turbines, the remaining three being built by Franco Tosi, Lignano.—*Translated and abstracted from La Revue Electrique (Paris), June 15.*

ELECTROLYTIC IRON.

A new process of making iron plates and tubes direct from the ore has been invented by Sherard Cowper-Coles, the well-known English electrometallurgist, which appears to open up new possibilities in metallurgy. Ordinary cast-iron or iron ore, or material unfitted by certain ingredients for ordinary making of high-grade iron or steel, is put into an acid bath, and connected to the positive pole of a dynamo. For tubes the negative electrode is a wooden core covered with a sheet of lead, a similar flat surface being provided for plates. When the tube deposited by electrolysis has reached the desired thickness, it is taken from the bath, and is then heated to melt the lead and remove the core. The tubes and plates cost much less than those obtained by melting and rolling. The iron produced is superior in quality, and it is believed to be possible not only to utilize iron waste and inferior ore, but to apply the process direct to ore in its bed, thus making unnecessary much of the labor at present connected with the mining and cleaning of ore.—*Abstracted from The Engineer and Iron Trades Advertiser (Glasgow), June 29.*

THE MEASUREMENT OF TELEPHONE CURRENTS BY THE ARNO GALVANOMETER.

The ever-increasing use of the telephone and the adoption of telephonic receivers in wireless telegraphy have created a need for an instrument capable of measuring telephonic currents. In 1906 Duddell invented a thermo-galvanometer which is particularly suitable for measuring such currents. Quite recently Riccardo Arno has designed a much more sensitive galvanometer based on an entirely different principle. He had observed that when an iron or steel disk or cylinder is placed in a rotary magnetic field and subjected at the same time to the action of periodic currents, even of feeble intensity, a considerable variation in the hysteresis is produced. This action is the greater the higher the frequency of the currents, other conditions being equal. Therefore, with the high-frequency telephone currents or those produced by Hertzian waves the variation is still noticeable, even though the currents be very feeble. In order to utilize this phenomenon, Arno employs two magnetic fields rotating in opposite directions, of the same intensity and frequency, each



THE ARNO GALVANOMETER.

acting on a hollow steel cylinder. The two cylinders are mounted on a common vertical axis, constituting the movable part of the apparatus. One of the two cylinders may be subjected at the same time to the action of a secondary magnetic field produced by the telephone currents traversing a coil surrounding the cylinder, and having the same axis as the latter. Under these conditions the hysteresis of the cylinder undergoes a certain variation, and the movable portion, which is normally in equilibrium, begins to deflect. In his first apparatus Arno produced the rotating fields by a system of three coils with iron cores operated by three-phase currents. With equal frequency of the rotating fields and definite frequency and intensity of the secondary magnetic field, the intensity of the rotating fields is of considerable importance. If its value is increased, the result will be a corresponding increase in the deflection of the movable portion up to a certain limit, depending upon the mechanical sensitiveness of the apparatus. As three-phase currents are not generally available, the latest type of instrument has been adapted for single-phase current, and in order to make the mechanism lighter and more sensitive, the two cylinders are replaced by a wire, a small tube, or a spiral of magnetic material. The coil traversed by the telephone currents to be measured has a resistance approximately equal to that of a telephone receiver. If the currents of Hertzian waves employed in wireless telegraphy are to be measured, a coil is employed with a sufficient number of turns to present an impedance such that the entire system and apparatus at the receiving station are in resonance with those at the generating station. The apparatus is so sensitive that a considerable deflection will be produced by speaking into a telephone, even if a resistance of 100,000 ohms is connected in the circuit.—*Translated and abstracted from L'Industrie Electrique (Paris), June 25.*

A NEW ELECTRIC CLOCK.

A new self-contained electric clock, operated by a single dry battery, has been invented by a Mr. Kutnow, and will shortly be put on the market by the Eureka Clock Company, Limited, of London, Eng. The clock has no pendulum, is noiseless in operation, and will go in any position, and it is announced moreover that the price will compare favorably with that of a spring-operated clock of equal quality. The balance wheel is controlled by an isochronous spring and is given an impulse every three seconds by means of an electromagnet on the wheel. The movement is transmitted direct to the seconds hand.—*Abstracted from Electrical Engineering (London), June 17.*

Erie Tests the Hudson Tube.

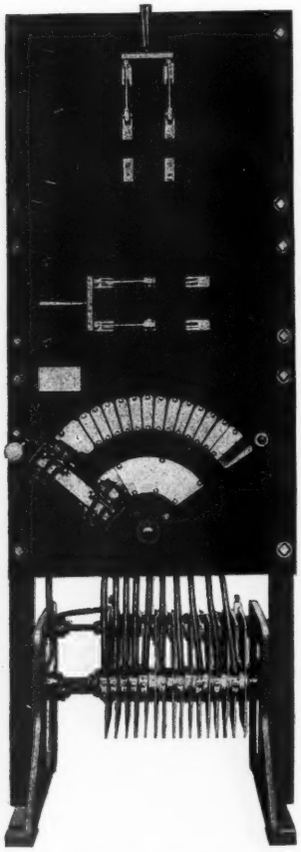
An experimental train was run in the Hudson Tunnel last week from the Erie station in Jersey City to the New York terminal, at 50 Church Street, in five-and-a-half minutes. As six minutes will be the regular schedule, the Erie officials believe that commuters using the new tube will save about fifteen minutes from Jersey City to Church and Fulton streets when the trains are running regularly, beginning August 2.

INDUSTRIAL SECTION

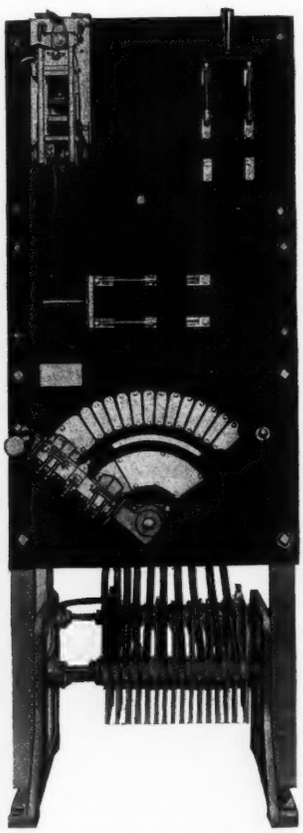
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

New Line of Motor Starters.

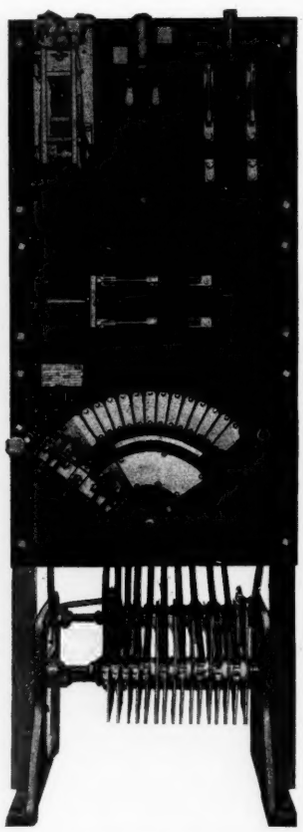
Recognizing that there is a demand for a motor starter of rugged construction, the Electric Controller and Manufacturing Company, of Cleveland, Ohio, has developed and placed on the market a new line of starters which are essentially of mill-type design.



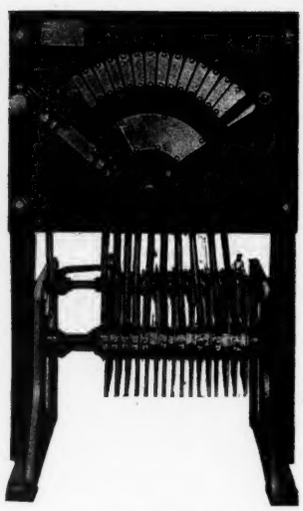
MILL TYPE MOTOR STARTER —FORM A-1.



MILL TYPE MOTOR STARTER —FORM A-2.



MILL TYPE MOTOR STARTER —FORM A-4.



MILL TYPE MOTOR STARTER —FORM F-1

In designing these mill-type motor starters, the Electric Controller and Manufacturing Company has attempted to interpret severe operating conditions, and this has necessarily led to the use of some new features. Mill-type motor starters are made in panels, have supporting feet, and are completely self-contained. The dimensions of the different forms vary only in height. In width, nothing projects beyond the slates, so that adjacent starters may be placed side by side, forming a continuous control board. The starters are furnished in several forms, beginning with a very simple form, and elaborated on to embrace such features as no-voltage release, overload protection for running, and separate and different overload protection for accelerating. In explanation of the last-named feature, this design allows more current to flow through the motor during starting than during running. If a motor be connected to a load having large inertia—such as a hot saw or a press with a heavy flywheel—the mere accelerating of the load demands a very considerable expenditure of energy. Since this starting is relatively infrequent, the motor will not be injured by employing a starting current in excess of the running current. Yet the starting time will be materially reduced. There are, in fact, numerous instances where it is desirable to allow an accelerating current larger than the running current.

Experience has shown that no-voltage protection which is secured by a spring return arm, is open to the following serious objections: First, the spring is likely to be either broken or weakened so that upon voltage failure the arm does not return to the off position. Second, the contacts may become so roughened that the spring is not powerful enough to move the arm. Third, an ignorant operator may block the arm in the off position, so that it is impossible for the spring properly to perform its function.

If, through any cause, the arm is not returned to the off position upon voltage failure, the motor will necessarily be subjected to a damaging overload upon the return of voltage. In the mill-type motor starters, the danger of a broken or weakened arm spring is absent, because no such spring is used.

The no-voltage protection is secured entirely by means of a magnetic switch, which opens upon failure of voltage. This same magnetic switch in connection with an overload coil, is used for securing overload protection. Since the overload feature must stand the abuse and have the characteristics of a circuit-breaker, the Electric Controller and Manufacturing Company believes that it should possess the advantages and arc-breaking ability of a circuit-breaker.

The following valuable features sum-

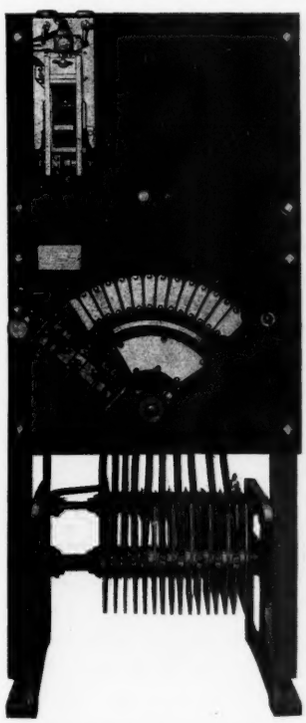
marize the operation of this type of motor starter:

(1) The magnetic switch can be closed only by bringing the arm to the off position, preventing injurious overloads to the motor upon the return of voltage after voltage failure.

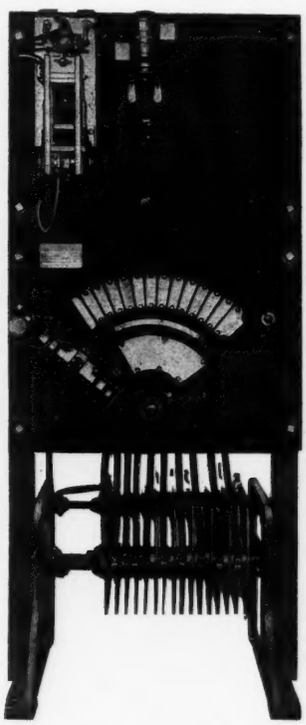
(2) The magnetic switch can be held closed to the arm on any accelerating step only by holding in a push-button. This prevents leaving any of the starting resistance permanently in circuit, and thereby burning out this resistance.

(3) The magnetic switch will maintain itself closed only when the arm is at the full-on position.

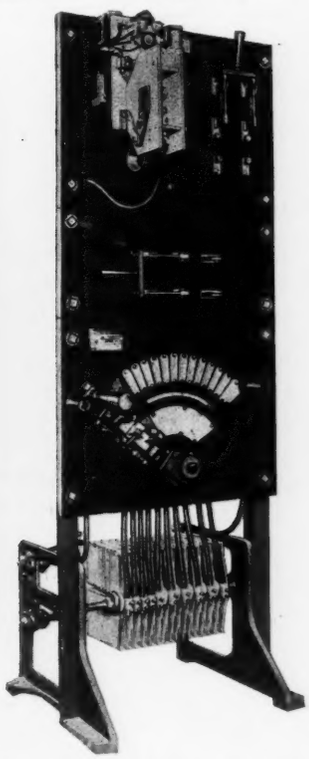
The resistance fingers, contacts, etc., used in the mill-type motor starters are of the same design and kind of material that the Electric Controller and Manufacturing Company uses in controllers for heavy service. It states, therefore, that this starter can be rightly called of mill-type design, and is well able to stand the abuse and severe service which the most ruggedly constructed mill-type motor can be expected to encounter.



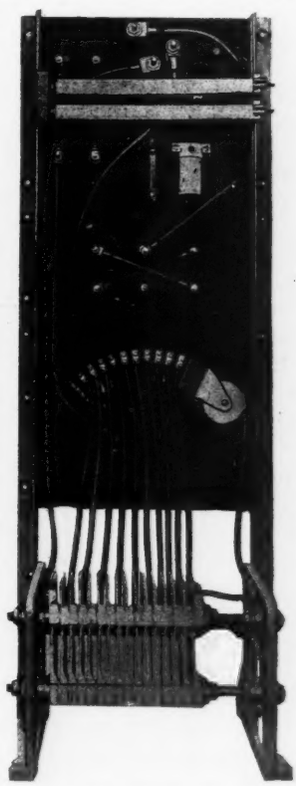
MILL TYPE MOTOR STARTER —FORM F-2.



MILL TYPE MOTOR STARTER —FORM F-4.



MILL TYPE MOTOR STARTER— FORM F-4 (Three-quarter View).



MILL TYPE MOTOR STARTER— FORM F-4 (Rear View).

Low-Pressure Turbine in Textile-Mill Service.

At the Bernon Mills of the Manville Company, Georgiaville, R. I., a 300-kilowatt Westinghouse low-pressure turbine is being installed to take steam at atmospheric pressure from the exhaust of a Corliss engine, driving a three-phase, sixty-cycle, 600-volt alternator to supply additional power and lighting for the mills. The turbine is operated without superheating and exhausts into a condenser maintaining a vacuum of twenty-seven inches. Besides the lighting service for the mills, the distribution system supplies a synchronous motor direct-connected to mill line shaft.

A Prompt Delivery.

The International Acheson Graphite Company, of Niagara Falls, N. Y., reports a recent demonstration of its facilities for prompt shipments of orders. Between 1 and 2 o'clock on the afternoon of Friday, July 2, a telegraphic order, calling for the shipment of a carload of electrodes eight inches by forty-eight inches by express, was received. The works and an express company were immediately notified. At 5 p. m. an express car was delivered on the track in front of the products building. At 5:30 p. m. a locomotive on the Niagara Junction Railroad was pulling away with the loaded car for delivery to the Michigan Central Railway. It left Niagara Falls about 6 p. m., Buffalo about 8 p. m., and very early on Saturday morning the electrodes were delivered to the consignees in Chicago, Ill. The regular shipments of the day were not interrupted.

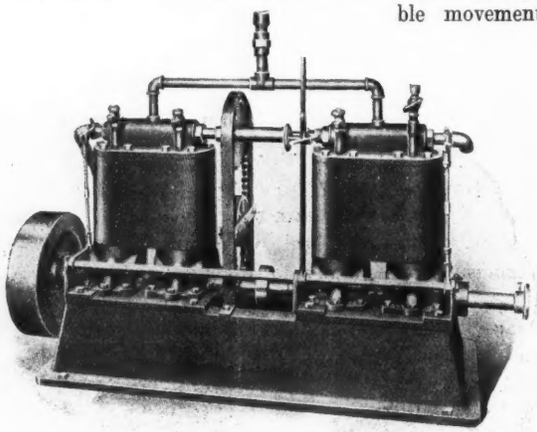
The value of the service to the customer is more apparent when it is known that if the business judgment of the Acheson Graphite Company had not been such as to have these very large electrodes in stock, a delay of from ten to twelve weeks would have resulted in filling the order.

The Rothchild Engine.

The object of the engine illustrated herewith is to furnish an engine that shall have the economy of the most perfect type of present stationary engine, simpler in construction, and more convenient to operate than any engine of the reversible kind now in use. It is economical, simple and reversible at the same time.

The valves of this engine differ from all others both as to location and movement. They are located in the cylinder heads and driven by a continuous rotary motion taken from the main shaft, the latter making three revolutions to one revolution of the valve. The valve is cylindrical in shape, and has three ports at equal distance on its circumference, thereby employing one port for each revolution of the main shaft. The port in the valve casing is equal in width to the blank space between any two ports on the

cylindrical valve. It will be seen from this that the engine can obtain steam by moving in either direction. The forward and backward movement of the engine is controlled by the cut-off within the cylinder valve. The cut-off separates the live steam from the exhaust, and its port arrangements are such that they control, in the most economical way, both the admission and exhaust of steam, according to the load or speed required. The cut-off extends beyond the valve casing far enough to permit the attachment of the controlling lever. The cut-off may be moved or changed at pleasure—without detriment to the exhaust—to expose the port either for a forward or backward movement of the engine, depending upon which way the cut-off is tilted. The position of the cut-off also controls the amount of steam to be admitted to the piston. By this construction it will be observed that there is a continuous rotary valve moment between a stationary case and a cut-off which may be varied to suit the occasion or circumstances. This enables the valve to enter unimpaired steam at a positive point for the piston to receive the same.



ROTHCHILD ENGINE.

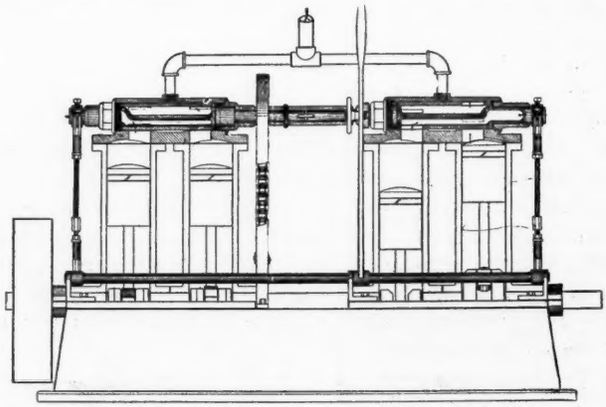
The variable cut-off inside of the cylindrical valve cuts off the supply of steam at any desired point of the stroke to suit the occasion, and may be operated by hand or governor. The seating contacts of movements contained in the valve are self-sealing and arranged so as to take up their own wear by differential pressure.

This engine differs radically from all other cut-off engines in consequence of the continuous rotary movement of the valve, giving the latter a movement in one direction so that it can be met and regulated as to its steam admission with very slight movement of the cutoff, and this is necessary only when there is a change of load requiring a different amount of steam, or a change of direction requiring the reversing of the engine; otherwise the cut-off remains stationary.

The entire control of the engine as to starting, stopping, regulating, or reversing is done by one simple lever located conveniently to the operator.

All joints and connections along the line of movements of the valve are of the toggle type, permitting an easy and flexible movement, also providing a thrust endways to make steam joints in place of stuffing boxes, and permitting the valve to seat without being interfered with by the motion of the stem.

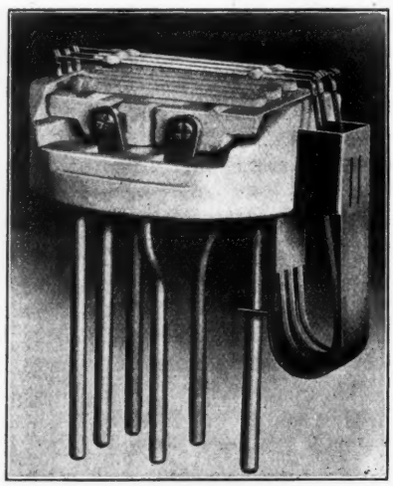
This unique engine is manufactured by the Rothchild Engine Company, whose offices are at 102 Centre Street, New York, N. Y.



SECTIONAL VIEW, ROTHCHILD ENGINE.

Nernst-Lamp Improvements.

Another marked improvement in the Westinghouse Nernst system is the new spring holder. This holder consists of a one-piece porcelain base, same as the old holder, and receives the wafer heater in the same manner, but is provided with an entirely new device for holding the glowers. On one side there is attached a metal stamping consisting of a series of springs, one for each glower, covered by a metal guard. A corresponding number of rigid upright supports fit into slots in the opposite side of the porcelain. Small platinum jaws to receive the glowers are welded to the tips of the springs and to the tips of the upright supports.



NEW SPRING HOLDER FOR NERNST LAMPS.

The glowers are provided with fused beads at the ends of their platinum leads which prevent them from slipping through the jaws of the holder. Replacement consists of the simple operation of inserting the bead of the glower in the jaw on the spring side of the holder and then drawing the spring forward sufficiently to allow the other bead to drop into the corresponding slot on the opposite side of the holder.

The spring tension is sufficient to draw the glower into place, which is done automatically without further attention on the part of the operator. Contact is made automatically. The pressure of the spring keeps the glowers in their correct position and does not permit them to assume any other position due to expansion and contraction.

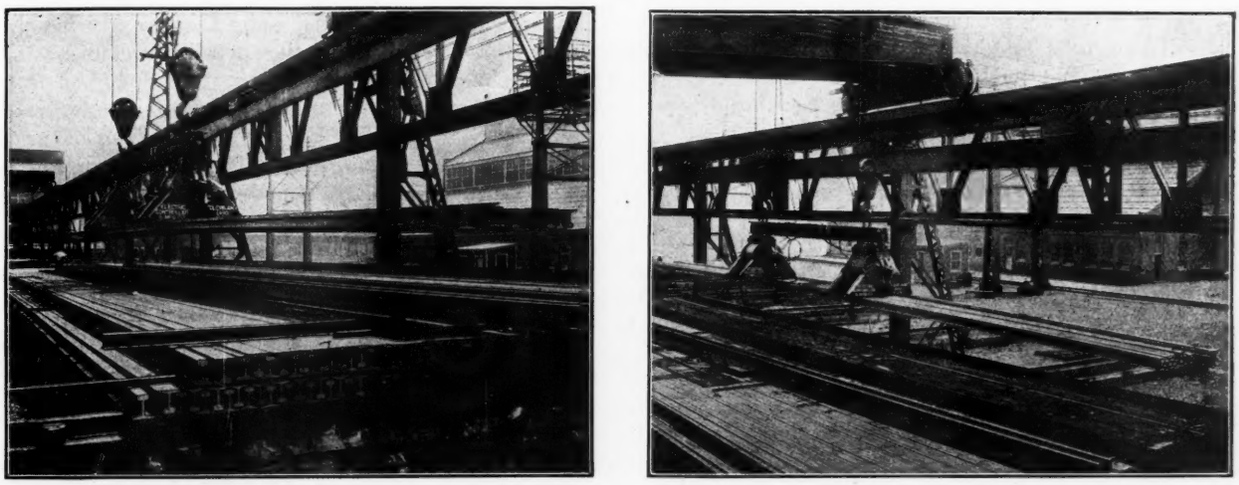
This device makes the replacement of glowers so simple an operation that it can be done by anyone, without having had electrical experience. It greatly reduces the trimmer's time and makes it impossible for him to replace the glowers in any but the proper way.

Rail-Handling Magnets at Gary.

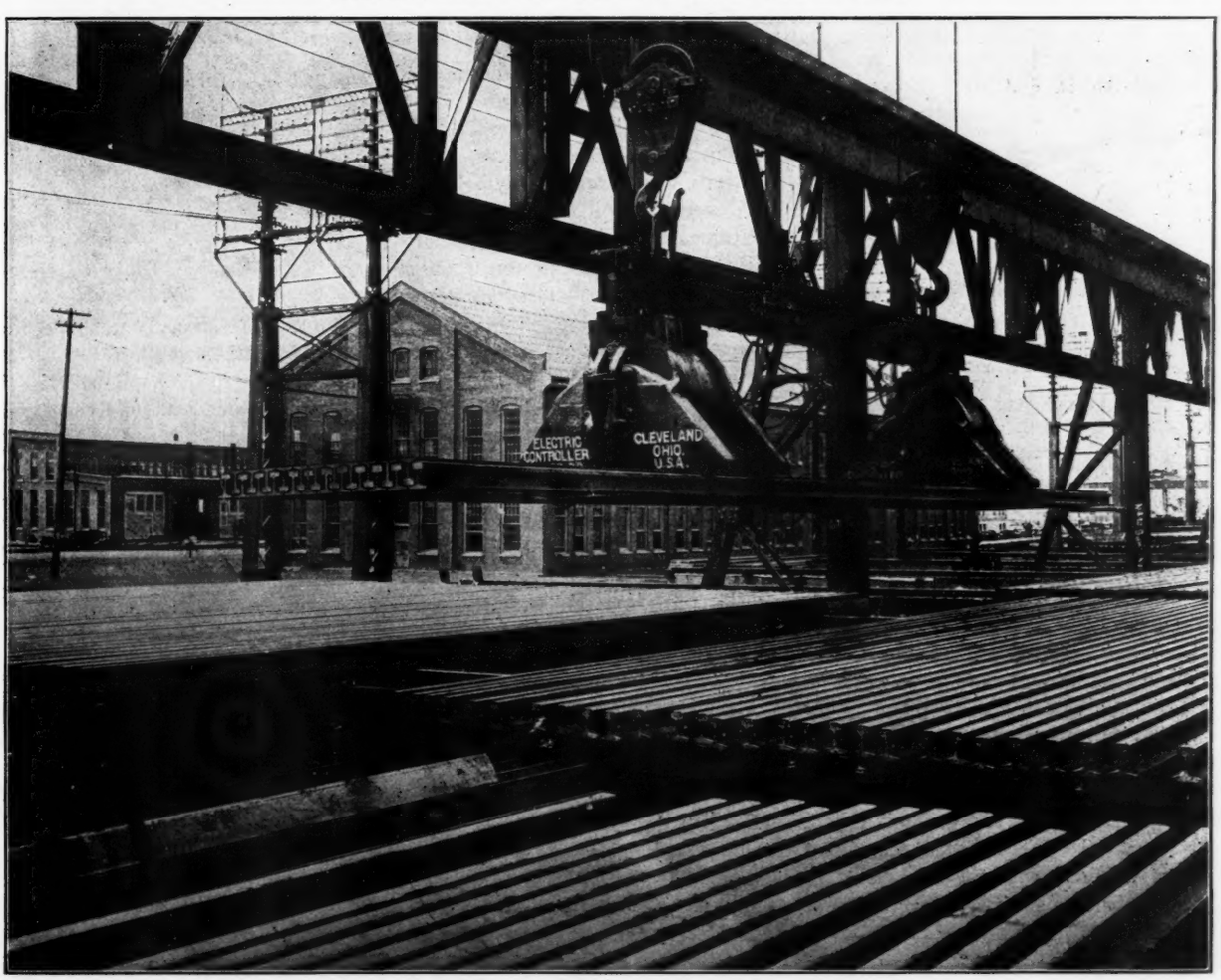
During the past few years the saving that can be accomplished by the use of lifting magnets has been generally recognized, and many new applications of magnets have been made. The Electric Controller and Manufacturing Company of Cleveland, Ohio, a pioneer in this field,

has not only introduced improvements in design, but has designed and applied new types of magnets to new kinds of service.

Such an application requiring a new design of magnet, is the handling of the entire output at the immense rail mill of the United States Steel Corporation's plant at Gary, Ind. This mill is of the most modern design in every respect, and electric power has been used throughout, even to the driving of the rolls, by 6,000-horsepower motors. The handling of the finished rail by electric power, through the use of lifting magnets, was therefore a logical conclusion, providing a successful magnet could be made. The handling of the rail output by means of magnets was particularly desirable from the following considerations. (1) Sufficient labor alone could be dispensed with to make the application commercially attractive. (2) A large saving in time of handling would be effected. (3) Very much less timber-spacing material was necessary in loading.



E. C. AND M. MAGNET HANDLING A LOCKED SECTION OF 60-FOOT RAILS AT THE RAIL MILL OF THE INDIANA STEEL COMPANY, GARY, IND. LIFTS ARE FROM 12 TO 15 TONS.



E. C. AND M. MAGNET HANDLING A LOCKED SECTION OF 33-FOOT RAILS AT THE RAIL MILL OF THE INDIANA STEEL COMPANY, GARY, IND. LIFTS ARE FROM 10 TO 12 TONS.

(4) There being no possibility of bending the rail when loading by magnets, loss on this score would be eliminated.

While it is desirable, from the standpoint of the rail mills and railroads, to ship rails in locked sections, yet this is an arrangement of rails which is particularly difficult to handle with a magnet.

The difficulty arises from the fact that the top layer of the rails practically short-circuits the magnetic field and none but a very powerful and carefully designed magnet would have sufficient strength to penetrate the top layer of rails and lift the bottom layer.

The magnets, which were furnished by the Electric Controller and Manufacturing Company, have been very successful and have lifted not only locked sections of thirty-three-foot rails, but have also lifted locked sections of sixty-foot rails with an aggregate load of fifteen tons.

Central Electric High-Tension Disconnecting Switches.

The increasing use of high voltages in electric transmission systems has created demands for many special devices, among which are the so-called high-tension disconnecting switches, of which many types have been developed and are extensively

HIGH-TENSION DISCONNECTING SWITCH.

employed for sectionalizing lines or disconnecting lightning arresters, oil switches, etc., from live circuits.

When oil switches or circuit-breakers are tied in on busbar sets, it is essential that disconnecting switches be provided whenever possible, as the installation of these switches will permit the oil circuit-breakers to be cut out of service for inspection or adjustment.

To meet the demands for disconnecting or sectionalizing switches, the Central Electric Company, Chicago, Ill., is marketing a number of different types, embracing both indoor and outdoor forms, and adapted for use on circuits ranging from 300 to 2,000 amperes at pressures of 2,200 to 110,000 volts.

The indoor forms for use on switchboards have the contacts and conducting elements mounted on corrugated porcelain pillars, in turn mounted on marble bases or adapted to be directly mounted on the switchboard panels.

The blades are made of the highest conductivity copper, accurately machined and fitted into the contact clips, which are provided with suitable connection lugs.

When desired, the switches are provided with automatic safety locking devices, which not only secures the contact blade in a closed position, but also holds it in a predetermined open position, thus preventing accidental closing.

These switches are made in both front and back-connected types, or in a combination of the above, in some cases several switches being mounted on the same panel, and conveniently arranged to be used as busbar transfer switches.

All the various types are intended to be operated by means of insulated hook handles, as has become common practice.

The High-Voltage Pittsburgh Transformer.

Companies operating high-voltage transmissions frequently meet with demands for power at various points along their lines. Usually the consumer requires only a small amount of power, but if his field is systematically developed it will be found that a considerable revenue may be derived from such consumers. A matter of utmost importance in this work is choice of a transformer which will operate with safety to the consumer and which is free from expense and trouble on account of the high line potential.

The illustration shows the new Pittsburgh transformer for supplying consumers directly from high-potential lines. The features of this new transformer are its substantial mechanical construction and its high insulation. The importance of insulation strength will be realized when it is considered that a breakdown in a transformer of this kind is much more costly to remedy than a similar failure with 1,100 or 2,200-volt distributing transformers, and the property or safety of the consumer is subject to greater risks.

These transformers are made in the Pittsburgh standard core-type design, which is the most reliable construction for this work. The cases are cast-iron, and are provided with hangers for cross-arm suspension. The high-tension leads issue through very large porcelain bushings which are set in the case at an angle of thirty degrees away from the casing. These bushings are deeply fluted to secure large leakage surface, and the hole through which the lead passes is enlarged at the lower end to produce a dry-petticoat effect. The bushing projects well above the cement within the case, thus providing dry glazed porcelain insulation, which prevents leakage through the cement. This substantial bushing construction at once does away with the usual lead troubles of small transformers for this class of service.

The insulation of these transformers has been most carefully developed. Pittsburgh coils being of the core-type construction, present only smoothly curved surfaces for the application of insulating materials—that is to say, that insulating material being wound on surfaces which are practically cylindrical, is not injured in the process of winding, and is therefore used in its full effective strength. The absence of sharp corners or edges greatly simplifies the insulation of Pittsburgh transformers. Between the high-voltage primary and low-voltage secondary is a heavy shield of built-up mica

HIGH-VOLTAGE PITTSBURGH TRANSFORMER.

reinforced with specially treated material, the breakdown strength of which is in excess of the A. I. E. E. specifications. This shield extends beyond the high-tension winding at each end of the coil.

These transformers are designed to secure high operating efficiency, combined with substantial construction and perfect insulation. The windings are thoroughly ventilated by means of oil passages between the core and the windings and between the various sections of the windings themselves, so that the windings are constantly cooled with currents of flowing oil. This results in a small temperature rise and also maintains the windings at a uniform temperature. Uniform transformer temperature rise is very important on account of the fact that unequal heating produces uneven expansions and contractions, which in time destroy the insulation, and lead to burn-out.

These transformers are manufactured by the Pittsburgh Transformer Company, Pittsburgh, Pa.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, July 10.—Probably the most famous Local Government Board inquiry into a loan for electrical purposes has just concluded at West Ham, a district just over the London border, and one which has, during the past three years, attracted a very large number of factories by the cheap rates at which electric power has been offered and supplied. At West Ham, the Electricity Committee has entered into a number of contracts to supply electric power for long terms of years, at prices down as low as one-third of a penny per unit, and this has formed a peg upon which a great deal of opposition to an application for sanction to borrow further capital to meet extensions has been hung. The West Ham electrical engineer has worked upon the principle that in arranging tariffs for large power supplies, the whole of the capital expenditure upon the original plant in the electricity works should not be taken into account, but only that upon the newer plant which most large works here have put in during the past two or three years to meet this new class of demand. Obviously, the capital charges per kilowatt upon this plant are very low compared with the original plant, and in this way very low charges can be offered.

A 200-volt, sixteen-candlepower metal-filament lamp has made its appearance upon the market here. At present there is considerable difference of opinion on the part of supply station engineers as to whether the public is really being educated up to using larger units of light, experience on this point seeming to differ in different towns. There is quite a strong body of feeling that consumers prefer to maintain their illumination at the old standard and to reduce their bills by the use of metal-filament lamps, rather than to improve the standard of illumination for the same money.

The Salford corporation has followed the Manchester corporation and installed an exceptionally large storage battery in order to assist the "peaks." An order has just been placed for such a battery running into some $40,000.

As a result of the recent daily newspaper campaign against the use of surface-contact tramways in London, the owners of the G. B. surface-contact system have served writs upon three newspapers for alleged libel. An action for breach of contract is also to be expected as against the London County Council.

It is a curious fact that the only two aluminum companies which Great Britain possesses are in a very bad financial position, and applications for compulsory winding-up orders have been made in respect of both. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JULY 10.—A new company has been formed by the consolidation of the wireless departments of the well-known Carpentier and Gaiffe firms of Paris, with W. O. Rochefort acting as chief engineer. Besides many naval posts which the new company has installed for the government, we may mention that it is about to equip a wireless post in Brazil for the government, which will rank among the largest in South America. It is to be located on the island of Fernando Noronha, and is expected to have a range of 1,000 marine miles, at least. At night, it may be able to signal across the Atlantic to the African posts. The new plant will have four 230-foot iron towers, placed at the corners of a 530-foot square, with the station building in the middle, and the power used will be about sixty horsepower. A large storage battery will be used in connection with the generating group.

I note the following French projects: At Vire, the municipality is arranging with one of the leading companies for the electric lighting of the town. It is expected that the Energie Electrique Company will secure the rights for electric light and power in various communes in the region of Grasse. At Montelimar, the Municipal Council is to grant the rights for electric lighting. A gas and electric system is being considered in the town of St. Etienne, and it was decided to give the concession to the French Edison Company. The localities of Granville, Dinard and Longueville are considering electric-lighting projects.

Prof. Mercadier is now able to operate his vibratory system of multiplex telegraphy upon a single wire, and has been making some very satisfactory tests between Lyons and Paris. Heretofore he was obliged to use a double line, so that he secures a great advantage in being able to work with a single wire.

The Swedish firm known as "Stora Kappelbergs" is making experiments in electric steel manufacture on a large scale, using the new Grönwall method, which has been lately patented. They are now running a 750-horsepower furnace on this principle, having ten tons' capacity.

In the Tyrol there is a new electric railroad line in operation in the neighborhood of Mendel. The first section of the road uses trains made up of motor cars and trailers, while the second section is on a steep grade and runs up to the elevated point of Mendel, so that a cable incline operated by electric motor drive is employed here, with special cars. The change from one system to the other is made at the midway point. On the first section there is used a 200-horsepower motor car carrying two motors, working on a 500-volt overhead trolley system. A. DE C.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

MEXICAN POWER PROJECT—A Mexican syndicate, it is announced, is planning to divert the Santiago River for a drop of 1,800 feet, thereby developing 90,000 horsepower, to be used to supply cities and mining camps in Aguascalientes and Zacatecas.

CHATTANOOGA RAILWAYS AND CHATTANOOGA ELECTRIC MERGER—By a deal just consummated, the Chattanooga Railways Company and the Chattanooga Electric Company have been merged into a single corporation, under the management of W. E. Boilleau, formerly manager of the Chattanooga Electric Company. Extensive improvements, entailing the expenditure of several hundred thousand dollars, are contemplated by the combined companies.

POWER DEVELOPMENT IN OREGON.—A mortgage for $15,000,000, given by the Wasco County Electric and Water Power Company to the Carnegie Trust Company of New York, to secure a bond issue to that amount, has been filed here. By the terms of the instrument, the power company is authorized to sell, for a period of 200 years, to the Portland, Bake City & Butte Railroad Company, one-half of all the power produced, the minimum amount of which is to be 60,000 horsepower. The first work undertaken as a result of the financing of the power company will be the erection of a 12,000-horsepower steam auxiliary plant on the Willamette River at Portland, and the building of 117 miles of railroad from Portland to the proposed site of the 60,000-horsepower hydroelectric plant on the Deschutes River. Work is to begin on both of these pieces of work on August 1. When the road and the auxiliary plant are completed work will begin on the hydroelectric plant. The main office of the Wasco County Electric and Water Power Company is at Condon. The company has a capitalization of $3,000,000, while the Portland, Baker City & Butte Railroad Company is incorporated for $2,000,000. A.

UNITED STATES LIGHTING AND HEATING COMPANY—The United States Lighting and Heating Company, capitalized in the state of Maine for $17,500,000, will, it is semi-officially reported, build its mammoth plant at Niagara Falls. The company is now negotiating for the necessary amount of power and for a site upon which to erect its plant. It is said that as soon as the contract for power is closed and the title of the land upon which the plant will be erected is transferred, ground will be broken. The power contract involves a delivery to the company of 1,000 horsepower at once, this amount to be increased to 3,000 horsepower when the plant reaches its full capacity. The United States Light and Heating Company contains in its directorate Edwin Hawley, chairman of the board of directors of the Chesapeake & Ohio Railroad; Newman Erb, of the Wisconsin Central; W. H. Silvertown, president of the Railway Steel Spring Company; J. E. French, chairman of the board of directors of the Railway Steel Spring Company; Mr. Starbuck, president of the New York Air Brake Company; Mr. Crandall, of New York, of Crandall Brothers, bankers and brokers, and Theodore Shonts, president of the Metropolitan Traction Company. The company has recently acquired the systems of the Moskowitz Lighting Company, of New York, and the Bliss Electric Car Lighting Company, of Milwaukee, Wis. The purpose of the company is to manufacture storage batteries and a system of electric lighting for installation on railroad trains. J. A. Smith, of New York, has been conducting the negotiations in behalf of the $17,500,000 concern, and these have reached a point so near to consummation that the above statements are authorized.

LIGHTING AND POWER.

(Special Correspondence.)

ALBANY, N. Y.—The New York Public Service Commission, Second District, has authorized the Buffalo General Electric Company to issue $242,000 first refunding five per cent gold bonds, for

extensions and improvements. The bonds must be sold at not less than ninety-seven.

PRESCOTT, WIS.—A twenty-five-year franchise has been granted to the Prescott Light and Power Company. C.

LEAVENWORTH, KAN.—It is reported that the Great Northern Railway Company will build another power plant here.

MILBANK, S. D.—Oscar Clausen, of St. Paul, Minn., has been granted a franchise to install and operate an electric-light plant. C.

SEATTLE, WASH.—The City Council has passed a bill appropriating $100,000 for building a new power dam at Cedar River. A.

LOS ANGELES, CAL.—The Board of Public Works will receive bids here until July 30 next for three 100-horsepower induction motors. A.

TALENT, ORE.—The Jackson County Light and Power Company has been incorporated for $10,000; A. W. Silsby and others, incorporators.

ESCONDIDO, CAL.—A $30,000 electric-lighting and power plant is to be built here. Crude oil is to be the fuel for the steam-generating plant.

COLUMBIA, S. C.—The Twin City Power Company has received authority from the Secretary of State to increase its capital stock from $1,000,000 to $3,000,000.

GEORGETOWN, CAL.—William Ross has filed a notice of appropriation of 2,500 inches of water from the Cosumnes River near here for electric power and other purposes. A.

GLENDALE, CAL.—An ordinance providing for the issuing of bonds for $60,000 for the acquisition of an electric-lighting plant has been given first and second readings by the City Council. A.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed in Los Angeles, Cal., for a $30,000,000 gas and electric company, to control all the gas and lighting plants in southern California.

BELLE PLAINE, MINN.—C. A. Arndt, St. Paul, and F. L. and S. J. Rauchwater, South Park, have incorporated the Belle Plaine Electric Light and Power Company, with a capital of $15,000. C.

RED BLUFF, CAL.—The Butte & Tehama Power Company has opened offices here preliminary to the beginning of construction on its proposed power plant on Mill Creek. The work will be in charge of Leon Bly. A.

BENSON, ARIZ.—The Benson Water Company, through its manager, Frank Treat, has made the announcement that it is the intention of the company to extend its water service and also establish an electric-lighting plant.

STEVENSON, WASH.—W. D. McNary and H. P. McNary, who have extensive interests at Shepherd Hot Springs, are preparing to develop electric power from Wind River for the purpose of lighting the buildings and grounds. A.

THE NIAGARA AND ERIE POWER COMPANY has been incorporated at Buffalo, N. Y., for electric-light, heat and power purposes. Capital stock, $100,000. Incorporators: C. F. Blair, M. J. Binkley, A. F. Tideswell, Buffalo.

ANTIGO, WIS.—Contracts to the amount of $50,000 have been let for improvements to the electric-light plant. A solid brick building, 55x140, will be erected, and an entirely new outfit of boilers and electrical machinery installed. C.

BUFFALO, N. Y.—The Niagara and Erie Power Company has been incorporated to manufacture electricity for light, heat and power, with a capital of $100,000. The incorporators are C. F. Blair, M. J. Binkley and A. F. Tideswell, Buffalo.

SEATTLE, WASH.—The Hanford Irrigation and Power Company will enlarge its power plant in Benton County and will put in new generating machinery to develop power to irrigate 11,000 acres of land just secured from the Northern Pacific Railroad Company. A.

NEVADA CITY, CAL.—A crew of surveyors, under the management of A. D. Foote, president of the Middle River Hydro-Electric Company, began this week preliminary surveys for that company's power plant and transmission system on the Middle Yuba River. A.

SYRACUSE, N. Y.—The Oswego County Light and Power Company has increased its capital stock from $100,000 to $1,000,000, according to a certificate filed by Henry D. Brewster, Ancil D. Brown and Willis H. Michell, of this city. The proportion of stock actually issued is $1,500.

ALBANY, N. Y.—The Syracuse Lighting Company has been authorized by the up-State Public Service Commission to execute a mortgage for $2,500,000 and to issue $143,000 bonds at once, the bonds to be sold at not less than 95. The company asked permission to issue $207,000 bonds, but had remaining unexpended $70,388, applicable to additions and betterments, under the $1,000,000 debenture issue of 1907. This amount will now be used in addition to the $143,000 just authorized.

TRENTON, N. J.—The Union Gas and Electric Company has been incorporated, with a capital of $18,000,000. The object of the company is to operate electric railroads and to build and operate electric and gas plants. The stock is divided into $6,000,000 common and $12,000,000 preferred.

COLUMBIA, S. C.—The secretary of state has granted the Twin City Power Company the right to increase its capital stock from $1,000,000 to $3,000,000. The principal place of business of the company is at Parksville, in Edgefield County. The directors of the company are Thomas J. O'Connor, D. M. Mackaye, G. J. O'Connor, G. R. Coffin and L. F. Dorn.

WALLACE, IDAHO—The Washington Water Power Company, of Spokane, has filed here a $15,000,000 mortgage to the Farmers' Loan and Trust Company of New York. The mortgage is to secure bonds for the construction of an additional power plant at Little Falls, Wash., for extensions to its present systems of power lines and to cover present indebtedness. A.

BUFFALO, N. Y.—A certificate of incorporation has been filed by the Niagara and Erie Power Company. The capital stock is $100,000, and the company will furnish light and power in Erie, Cattaraugus and Chautauqua counties. The directors are Charles F. Blair, M. J. Binkley, A. F. Tideswell, Howard S. Jones, Fred W. Ashford, Warren Tubbs, William K. Lyon and Thomas W. Callahan.

BAKERSFIELD, CAL.—The West Side Electric Company has applied to the Board of Supervisors for an electric transmission franchise covering the West Side oil fields from Sunset to McKitrick. Bids for the franchise will be received up to August 10. The franchise will be for fifty years and the successful bidder must pay to the county two per cent of the gross receipts after the first five years. A.

SANFORD, N. C.—Electric power from the Carolina Power and Light Company's plant, at Buckhorn Falls, has been turned on at Sanford Cotton Mills, and now their 11,000 spindles and 400 looms, which were formerly run by a 450-horsepower engine supplied by steam from four 100-horsepower boilers, are operated by electric motors. This is the second manufacturing plant in this town to use electric power, the Sanford Ice Plant being the first, and others will follow as early as wiring can be done, the power line having been completed only a few weeks ago.

COLUMBIA, S. C.—The negotiations which the Southern Power Company, of Charlotte, N. C., is making to secure a franchise from the Columbia City Council to enter the city and use its streets for lighting and power, have been held up temporarily by the summer holiday of the Council, which will reconvene the first Tuesday in September. Overtures have been made to the Southern Power Company to make its central office at Columbia, and the Chamber of Commerce of this city has appointed a special committee, composed of Gadsden P. Shand, C. Fitzsimmons and State Senator F. H. Weston, to wait upon the company. B.

LINCOLNTON, GA.—Some interest is being shown throughout the Southeast at this time in the proposed development of waterpower on the Savannah River, near this point, at Prices Island. Five years ago the location was investigated, but the matter was almost forgotten when recently, after the War Department had given permission for the starting of the work, the construction of a concrete dam was started, to cost from $3,000,000 to $4,000,000, with a watershed extending back up the river for twenty miles. The corporation in charge is the Twin City Power Company, composed of Northern capital. The power will be transmitted to Augusta, and other points, while the company will operate an electric railroad from the plant to Modoc, S. C. As soon as the first dam is completed it is proposed to build another twenty miles up the river, developing power sufficient to operate thousands of cotton mill spindles and to supply electricity for lights, power, etc., for a radius of 50 to 100 miles around. L.

FALLON, NEV.—The Nevada Hills and the Nevada Wonder mining companies are likely to build jointly at Fallon an electric power plant of sufficient capacity to furnish power not only for the two principal companies, but for the other mines of Fairview and Wonder camps as well. W. H. Webber, of Salt Lake, is manager of the Nevada Hills Company. The Nevada Wonder people, who are Philadelphia capitalists, have been figuring upon building a power plant of their own, with the intention of enlarging mine operations and building a mill, and when they discovered that the Nevada Hills Company owns the only important available water supply in the county, that of Horse Creek, they invited that company to join them in the power plant project. Coming just at the time when the Nevada Hills Company is installing heavier machinery and planning to build a large mill, the proposal was welcome, and there is little doubt but that an arrangement will be entered into which will be greatly to the advantage of both companies and both camps.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LANSING, MICH.—The Delta Traction Company, of Escanaba, has been incorporated. Capital, $300,000.

ELWOOD, IA.—It is reported that the Clinton, Maquoketa, Cascade, Dubuque interurban will be built this year.

WILLIMANTIC, CONN.—Present indications are that the Willimantic-South Coventry trolley line will be in running order about August 1.

IDAHO FALLS, IDAHO—A street-railway franchise was recently granted here, and work will begin soon on the construction of the line. U.

CRESTON, IA.—It is reported that arrangements have been made for the construction of the Creston, Winterset & Des Moines Interurban road to Winterset.

WINSTON-SALEM, N. C.—An interurban trolley line between Winston-Salem and Salisbury is now being promoted by T. H. Vanderford and associates of Salisbury, N. C.

WEBSTER CITY, IA.—The Fort Dodge, Des Moines & Southern interurban will electrify the Crooked Creek Railway and extend its lines through Blairsburg, Dows and Clarion.

BOISE, IDAHO—The Albion Interurban Railway System, Limited, connecting Albion and Burley with an electric railway twenty miles in length, has been incorporated. Capital, $150,000.

AUBURN, CAL.—W. S. Fletcher, of Pasadena, who has $300,000 invested here, has applied for a franchise to build an electric road from Colfax to Bath, sixteen miles. It will cost $250,000.

MINOT, N. D.—H. F. Bartling, of the Illinois Land Company, and others are considering the organization of a stock company to construct an electric line to the Canadian boundary. C.

ST. PAUL, MINN.—The Great Northern Railway Company is now using electric locomotives to haul trains through the Cascade Tunnel, in Washington, which is two-and-a-half miles long. C.

BOONE, IOWA—The Iowa Light and Traction Company has been organized to take over the Reynolds electric properties. The company is having lines surveyed to Ogden and Story City, with a view to building interurbans. C.

SPRINGFIELD, ILL.—The Herrin & Southern Railway Company has been incorporated to construct and operate a railway from Herrin, Ill., to Metropolis, Ill. Capital, $100,000. Incorporators: G. Willard, J. M. Dering, E. A. Howard.

SEATTLE, WASH.—D. C. Conover and E. P. Moran have been granted a franchise for an electric line between Bellevue and Lake Sammanish, construction work to begin at once. Main line to be six miles long, with several branches.

TOLEDO, O.—The Bellefontaine Commercial Club is backing a project to run a new electric line from Bellefontaine, O., to Richwood, by way of West Mansfield and York. In the meantime an automobile line is being operated to advantage over the route. H.

TOLEDO, O.—Application has been made by the Fort Wayne & Toledo Electric for a franchise through the streets of Bryan, O. The road will be about forty miles long and passes through Hicksville and Farmer. It is expected that it will be in operation before July of next year. H.

REXBURG, IDAHO—G. R. Armstrong, division plant superintendent, and N. P. Jones, division commercial superintendent, were in Rexburg recently, and after a conference with Local Manager Upham, decided to make about $20,000 worth of improvements in the local telephone system. U.

BUTTE, MONT.—The board of county commissioners has voted to extend to Manager J. R. Wharton, of the Butte Railway Company, a franchise to build a street car line in the McQueen addition. The new line will connect with the Garden tracks near the Pittsmont smelter, and go in a northerly direction for about a mile.

BOZEMAN, MONT.—At the annual election of the stockholders of the Gallatin Valley Electric Railway Company the following officers were chosen: H. S. Buell, president; George Cox, vice-president; Charles B. Anderson, secretary and general manager; H. S. Buell, George Cox, R. M. Hart, Charles B. Anderson and George P. Dier, board of directors.

TOLEDO, O.—The right-of-way for the extension of the Toledo, Bowling Green & Southern Electric from Findlay to Kenton, O., has been secured through Hardin County, and the line now looks like a certainty. Hancock County will donate the right through its territory, and George B. Kerper, promoter, promises to have cars running inside of fifteen months. H.

GREEN BAY, WIS.—A deal is projected between Geo. B. Caldwell, Geo. H. Taylor and L. E. Meyers, of Chicago, and the Hydro-Electric Company, which is constructing a waterpower on the Peshtigo River, looking to the construction of a line to Two Rivers, by way of Mishicot and Cooperstown; the building of a line north from Two Rivers, connecting Algoma, Kewaunee and Sturgeon Bay, and the possible absorption of the Manitowoc & Northern Traction Company by the Murphy interests, which own the street railway and lighting systems of Green Bay. C.

HARRISBURG, PA.—A special meeting of the stockholders of the Central Pennsylvania Traction Company has passed a resolution authorizing a $2,000,000 loan for the improvement of the company's system and the construction of a new car barn on North Cameron Street. The bonds will be four-and-one-half per cent, and $300,000 worth will be issued at once for use this year.

AUSTIN, TEX.—Articles of incorporation of the Pecos Valley Southern Railway, with a capital of $45,000, have been approved by the attorney-general, and filed with the secretary of state. The incorporators are: J. F. McKenzie, M. L. Swinehart, J. G. Love, F. W. Johnson, W. D. Cowan, B. R. Stine, Will P. Brady, Pecos; E. D. Balcome, Balmorhes; H. Robbins, Saragosa, and C. W. Griffin, Toyahvale.

TACOMA, WASH.—Articles of incorporation have been filed at Olympia, Wash., by George T. Reid, western counsel for the Northern Pacific, of the Connell-Northern Railway Company, with a $50,000 capital. Headquarters will be at Tacoma. It is announced that the object is to build and operate a railway from Connell, in Franklin County, to Adrian, with a branch to Ritzville and Tekoa, Adams County.

GLOBE, ARIZ.—That the Gila Valley Railway Company contemplates the immediate improvement of its line through the city from the passenger depot to the new Miami line, near the old Dominion smelter, was evidenced by the fact that at a recent session of the City Council, representatives of that company made formal application for permission to change not only the grade but the route of the present line.

BANGOR, ME.—The work of surveying the route for the electric road between Camden and Belfast has been started. This is believed to mean that this road will be built, and it is hoped that some of the grading may be done this season. The line will be twenty miles or more in length. The stockholders of the Rockland, Camden & Thomaston Street Railway Company are said to be back of the proposed extension.

MONTGOMERY, ALA.—The Hixon, Sumter and Northwestern Railroad Company, with nominal capital, has been incorporated at Livingston to build a line of road from Hixon, in Sumter County, to the Mississippi line, about forty miles to the northwest The incorporators are: John Alexander, G. G. Hixon, J. M. Hixon and J. F. Hughes. The road will reach a fine line of interests in that section, including both farm lands and timber.

DENVER, COLO.—Articles of incorporation of the San Luis Valley & Southern Railroad Company, with a capitalization of $1,000,000, were filed recently with the secretary of state. The object of the road is to open for agricultural purposes the Great Costilla Grant and develop the Labelle mining district. Franklin E. Brooks, former congressman, is president. A total of $10,000,000 gives an idea of the vastness of the plans of the incorporators.

HARRISBURG, PA.—Governor Stuart has approved a charter application for the Finleyville Southern Railroad, an electric line, to operate fourteen miles of system in Washington County. The capital is $84,000. The directors are: H. B. Hayden, president; J. E. Hayden, and S. C. Wilson, Monongahela; A. E. Hayden, Finleyville; T. Hayden, Castle Shannon; A. Henderson, Venetia; George Englert, Pittsburg, and J. R. Hayden, Muncie, Ind.

PHILADELPHIA, PA.—It is stated that Drexel and Company will exercise their option on August 15 to purchase the remaining $1,250,000 of the $5,000,000 collateral trust five per cent bonds of the Philadelphia Rapid Transit Company, which were authorized last fall. These bonds are due in 1957. The same bankers purchased $2,500,000 of the issue last December, and on May 15 took $1,250,000 more. The disposal of the remainder in August will bring the loan up to the full amount authorized.

SPRINGFIELD, ILL.—Articles of incorporation for the Springfield, Beardstown & Quincy Railway have been filed in the office of Secretary of State Rose. Capital stock, $25,000. The principal office is located at Springfield. Incorporators and first board of directors: Henry H. Colby, of Petersburg; Robert E. Bone, of Petersburg; Charles W. Houghton, of Petersburg; John S. Hurie, of Petersburg; John J. Tolan, of Farmingdale; George L. Harnsberger, of Springfield; William T. Gates, of St. Louis, Mo.

HOUSTON, TEX.—Lon C. Hill, who is promoting the proposed railroad from San Antonio to Brownsville, has stated his plans and the proposition that he will make to San Antonio. Mr. Hill said there were four available routes and that the company would choose the one where the most encouragement was given. He further stated that the roadbed of the proposed line would cost about $13,000 a mile on the average and, with the cost of equipment added, the cost of construction would total about $17,500 per mile. In speaking of the $100,000 bonus offered by San An-

tonio, he stated that he did not wish an option with that amount, as the sum was too small and the restrictions too great. As he stated the proposition, his offer to the city would call for $250,000, terminal and depot properties and rights of way through the city and Bexar County. Various San Antonio and St. Louis capitalists are interested.

ST. JOSEPH, MO.—It is stated that bonds have been placed in Brussels and London that will realize $8,000,000 for the construction of a line between Kansas City, St. Joseph and Excelsior Springs, including the construction of the bridge across the Missouri River at Kansas City, and the building of the necessary terminals. Construction work is expected to be started within sixty days. Leslie M. Shaw, former secretary of the United States Treasury, is interested in the project and has lately returned from Europe with the company's chief engineer.

GALESBURG, ILL.—Work on the construction of a $2,000,000 electric interurban railway in Missouri, in which Chicago capital is invested, has been started. The line will extend from Hannibal to Kirksville, Mo., 100 miles. Passengers and freight will be carried. The corporation will be known as the Hannibal & Northern Missouri Railroad Company. Capt. F. W. Latimer, Galesburg, Ill., is president; Nathaniel Board, Chicago, vice-president. On the board of directors are William B. Chandler, Chicago; J. Walter Farrar, Kansas City, and Henry Funk, Shelby County, Missouri.

INDIANAPOLIS, IND.—A contract, it is stated, by E. M. Bowman, president of the Indianapolis, Cloverdale & Vincennes Traction Company, was let recently to J. J. Burns & Co. of Chicago for the construction of the road between here and Vincennes. The company is to be financed by the issue of $2,000,000 worth of bonds. Negotiations for the bond issue are in progress at the present time between Louis A. Coleman, attorney for the company, and the Central Trust Company. The road, it is estimated, will cost $18,000 per mile to construct, the contract with Burns & Co., it is stated, being made upon this basis.

INDIANAPOLIS, IND.—Articles of incorporation have been filed in the office of the secretary of state for the Cincinnati, Louisville & Indianapolis Electric Railroad Company, capitalized at $100,000, with the declared intention of constructing an interurban railroad connecting Cincinnati, Louisville and this city, and reaching the following points: Greendale, Lawrenceburg, Aurora, Rising Sun, Patriot, Florence, Markland, Vevay, Lamb, Brooksburg, Kent, Blocher, Madison and Scottsburg. The following persons are named as directors: John C. Hooven, Clinton B. Hooven, Frank B. Shutts, William B. Mayo and Wilbur Hargitt.

MEXICO CITY, MEX.—A modification of the concession for the building of an electric railway from here to Puebla was conceded by the ministry of communications and public works to Andres Lefebre, the concessionist, and work on the road will begin soon. Under the new arrangements the electric line connecting Puebla and Mexico will be completed by September 17, 1913. Failure to have the track laid between the two cities by this date will involve a heavy fine for every additional day of delay. The new stipulations provide for the laying of twenty kilometers before September 17, 1910. For each of the succeeding years the concessionaire must put down not less than ten kilometers.

NEW YORK, N. Y.—After many years of delay, actual construction work has been started on the New York & Port Chester Railroad through the Bronx from One Hundred and Thirtieth Street and Harlem River to Port Chester. It is to be a six-tracked electric line, and will cost in the neighborhood of $21,000,000. It will be operated as a part of the New York, New Haven & Hartford Railroad Company's suburban service, and is one of the important links in the $200,000,000 plan, in which the Pennsylvania, New Haven and Long Island Railroad companies are engaged in Manhattan, Queens and the Bronx. This company began its fight for a franchise in the Board of Aldermen in 1903.

LORAIN, O.—The original plans for the construction of the Oberlin & Lorain Interurban Railway by way of Amherst have been altered, the present plans being to construct the road only as far as Amherst. The engineer who went over the line representing New York capitalists approved the line from Oberlin to North Amherst by way of South Amherst. The money to build the road is promised, subject to certain conditions which the promoters say will be easy to comply with. The annual meeting of the stockholders of the road was held in Lorain last week and the following directors were elected: W. F. Stanley, George J. Chapman, Conneaut; Captain R. Thew, Lorain; R. M. Summers, George C. Westervelt, Elyria, and M. D. Skeels and C. R. Summers, Oberlin.

GRAND JUNCTION, COLO.—Twenty miles of interurban electric lines will be built in the Grand Valley during the next two years as the result of the consolidation effected in Colorado Springs of the Grand Junction Street Railway Company and the Grand Junction Electric, Gas and Manufacturing Company. The holding company is known as the Grand Junction and Grand River Valley Railway Company and was incorporated here two months ago for $2,000,000. The bonds already have been underwritten for $1,225,000 and, it is stated, this money will be spent at once on improvements. The Grand Junction Electric, Gas and Manufacturing Company was taken into the new corporation at a valuation of $500,000 and will be at once enlarged to furnish adequate power both for lighting and operating the interurban system.

MANITOWOC, WIS.—It is said that George Caldwell, George Taylor and L. Meyers of Chicago and A. M. Murphy, W. P. Wagner, R. M. Howard, of Green Bay, and F. H. Josslyn, of Oshkosh, propose to transmit power from the Peshtigo River above Green Bay to Manitowoc and Two Rivers. They are also interested in an interurban project which may lead to the absorption of the Higgins line, the Manitowoc & Northern Traction Company, between here and Two Rivers, and it is also reported that the new deal will probably result in the connection of Manitowoc with Green Bay via Two Rivers, Mishicott and Cooperstown. Another deal reported is the building of an interurban north from Two Rivers to Algoma, Kewaunee and Sturgeon Bay, along the lake shore. If these plans are carried out and the Milwaukee & Northern connects Sheboygan and Manitowoc, as now planned, there will be a continuous interurban line from Sturgeon Bay south to Chicago along the west shore of Lake Michigan. The promoters are now building an immense power plant on Hign Falls on the Peshtigo River.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

VELASCO, TEX.—The Brazos Telephone Company has been incorporated with a capital stock of $10,000. W.

LYONS, NEB.—The Lyons Independent Telephone Company has been incorporated with a capital stock of $25,000. W.

DES MOINES, IOWA—The Mutual Telephone Company will spend $100,000 in extending and improving its system. C.

VICTORIA, B. C.—The British Columbia Telephone Company will place its wires underground at an approximate cost of $50,000.

CŒUR D'ALENE, IDAHO—The Interstate Telephone Company has begun improvements on its lines, which will cost about $8,000.

OVANDO, MONT.—The National Forest Service is constructing a telephone line, twenty-two miles long, to the Seeley Lake ranger station. C.

NORTHPORT, WASH.—The Farmers' Telephone Company has been organized and will install telephones all through Deep Creek farming section.

HOQUIAM, WASH.—More than $10,000 will be expended rebuilding the entire telephone system of this city by the Pacific States Telephone and Telegraph Company.

KINSTON, N. C.—A franchise, after much debate, has been granted to the Carolina Telephone and Telegraph Company to operate in this town. The term of the franchise is twenty years. L.

SAN LUIS OBISPO, CAL.—A wireless station has been erected here for the purpose of relaying messages between San Francisco and Los Angeles and to report vessels passing up and down the coast.

OAKLAND, CAL.—Proposals are now being received for the construction of a central telephone exchange at Fruitvale, Cal., by the Home Telephone Company of Alameda County. The building will cost about $6,000.

HOPE, IND.—A new company, headed by J. W. Aspy, has purchased the Hope and the Hartsville telephone plants and has arranged for long-distance connections over the Bell and the Independent toll lines. The two systems will be combined and improved. S.

NAPA, CAL.—The Imrie Farmers' Telephone Company has been organized at this place to construct and operate rural telephone lines along certain highways of this county. The directors are W. G. Furber, H. S. Swan, F. N. Zettle, E. H. McMillan and Wm. McKenzie.

DECKER, IND.—The White River Valley Telephone Company has incorporated with a capital stock of $10,000. The company is in the market for material to build and equip a new telephone system in Knox County. Directors, J. F. Breithaupt, D. N. Lane and Richard Ready. S.

TOLEDO, O.—James S. Brailey, of Toledo, this week purchased at mortgage sale the property of the Rome Home Telephone Company, of Rome, N. Y. The price paid was $20,100, and it is said the purchase was made for the stockholders. The company carried a mortgage of $140,000. H.

LOWELL, MASS.—The Cumberland Telephone and Telegraph Company reports gross earnings for the month of May of $524,954, against $503,357; net earnings of $256,397, against $210,567, and surplus, after charges and taxes, of $186,390, against $174,460.

For five months the gross earnings were $2,643,848, against $2,554,614, and net earnings $1,158,620, against $1,062,615. The surplus, after charges, was $915,441, against $874,980.

OMAHA, NEB.—The first step in the proposed consolidation of the Bell telephone interests in Nebraska, Iowa, Minnesota, North and South Dakota, has been taken by centering the management of these five companies in Casper E. Yost, of the Iowa Telephone Company, with headquarters here. C.

MONMOUTH, ILL.—The Monmouth Central Union Telephone plant has been purchased outright by the Monmouth Telephone Company. For weeks and even months the deal has hung fire and at one time it looked as though the consolidation would fall through, but the project has been finally consummated.

DECKER, IND.—The recently incorporated White River Valley Telephone Company, having purchased the Wabash Home Telephone Company's property, announces that the plant will be remodeled, improved and extended. Considerable new equipment will be installed in the exchange station. D. N. Lane, Richard Ready and J. F. Breithaup, directors. S.

INDIANAPOLIS, IND.—Articles of incorporation have been filed with the secretary of state by the Indiana Telephone Toll Clearing House. The capital stock is $10,000. This company proposes to conduct all the business relating to a system of toll clearances for the independent lines in the state. J. W. Coffey, W. J. Uhl and Theodore Thorward are the directors. S.

SHERIDAN, WYO.—The Sheridan City Council, at its last meeting, granted a franchise to an independent company, and Sheridan and surrounding towns will soon have two telephone systems. It is expected, as a result of the independent company securing this franchise, that a strong rival of the Rocky Mountain Bell Telephone Company, which has had a monopoly in Wyoming, will enter the field.

SIOUX CITY, IOWA—Announcement is made by W. R. Sly, general manager, with headquarters in Sioux City, of the sale to the Nebraska Telephone Company, of Omaha, of the Iowa Clark Auto Company and the Nebraska Clark Auto Company, for $100,000. The properties were turned over to the Omaha Corporation, which is the Bell Telephone Company, July 1, last. The Iowa Clark Auto Company and the Nebraska Clark Auto Company have been in operation about six years. Alfred S. Clark, of Providence, R. I., a wealthy capitalist, was president, and W. R. Sly, of Sioux City, general manager. Originally the companies included about 40 cities and towns equally divided between Iowa and Nebraska. The automatic phones were used at first, but were discarded later for manual service, when toll connections were established with the Bell Company.

PHILADELPHIA, PA.—The National Telephone and Telegraph Company, the charter for which has been applied for at Harrisburg, by C. E. Wilson, general manager, and Clarence L. Harper, a director of the Keystone Telephone Company, and F. R. Shattuck, attorney, has for its object to acquire, construct and operate lines, through the state of Pennsylvania, to connect with other lines running west to form a long-distance telephone system. There are at present 43 independent telephone companies in Pennsylvania that are members of the Eastern Traffic Association, which is an existing organization for independent lines to formulate long-distance rates. Three of the companies, "the Forest Telephone and Telegraph Company," "the Charleroi Telephone Company" and the "Independent Telephone Construction Company," joined the association July 1, 1909. This association also includes in its membership eight companies in West Virginia, seven in New Jersey, one in Delaware, one in Ohio and three in Maryland. The capitalization is set at $100,000,000, and the new company is considered a consolidation of the principal independent telephone companies being formed by representatives of Pennsylvania, West Virginia, Ohio, Indiana and Illinois independent telephone concerns.

NEW PUBLICATIONS.

ANNUAL REPORT OF THE WIRE DEPARTMENT, Boston, Mass.—The 1908-1909 report of James E. Cole, Commissioner of Wires, Boston, Mass., has just come to hand. Mr. Coles shows, with the aid of tabular matter and some excellent illustrations, the progress that has been made in the city of Boston toward putting underground the various complicated overhead systems of wires in selected districts. The report also contains a list of fires and miscellaneous troubles due to electricity, accidents to persons due to electricity, and various other matters pertaining to electrical transmission and the work of the Wire Department.

TELEPHONE COMPETITION, OPPOSITION AND CO-OPERATION.—The Information Department of the American Telephone and Telegraph Company has issued to the stockholders a statement concerning the value of the property of the Bell System, comprising the American Telephone and Telegraph Company and its associated holding and operating companies. This tabulation shows that the value of the property exceeds the capital obligations against it. The Bell System, comprising the thirty Bell associated operating companies, has 3,215,245 stations and 7,800 connected independent companies' lines or systems, with 1,150,000 stations, making a total of 4,365,245 stations. In the local or territorial area of these companies the system has 1,276,000 miles of toll lines, connecting the various exchanges with each other, making comprehensive territorial systems. These territorial systems are connected with each other by 456,000 miles of long-distance lines, forming a universal system. The bulletin also analyzes the companies not connected with the Bell System, taking up in detail the investment and the earning possibilities.

HYDE'S TELEPHONE TROUBLES AND HOW TO FIND THEM—The twenty-fifth anniversasry edition of "Hyde's Telephone Troubles and How to Find Them" has been published by W. H. Hyde & Company, Milwaukee, Wis. This compact little booklet of fifty-six pages contains in condensed and readily located form many valuable suggestions for the "trouble man" on magneto and central-energy telephone systems. The book is illustrated with a large number of diagrams and contains also a valuable manual of construction labor costs. These are arranged in tabular form and give the values in units for estimate work.

A NEW SYSTEM OF ELECTRICAL TRANSMISSION OF PICTURES—An interesting little booklet has been written in German by Dr. Robert Schönhöfer, of 45 Seidengasse, Vienna, Austria, and entitled "Ein Neues System der Elektrischen Fernphotographie." The system makes use of selenium cells at both the transmitting and receiving stations. The connecting circuit may be of the simplest kind and may be grounded. At the transmitting station the picture to be sent is enlarged by means of a projection apparatus and thrown upon a surface containing a multitude of selenium cells. Each of these is connected to a synchronizing apparatus on one side and to ground on the other. The synchronizing apparatus is connected through a battery and the transmitting line to a similar apparatus at the receiving end. From each element of the synchronizer at the receiving station a connection goes to a surface of corresponding selenium cells similarly connected. There is also provided at this end a source of light capable of reflecting the rays from the selenium-cell surface to a photographic apparatus which reproduces the picture. In this manner small elements of the picture are transmitted one at a time and, depending upon the number of these elements, the picture can be reproduced with considerable fidelity. The booklet is concluded with some interesting opinions about the possibilities of transmitting moving pictures by electrical methods.

NEW MANUFACTURING COMPANIES.

JERSEY CITY, N. J.—The Anderson Winding Machine Company has been incorporated to manufacture electrical machinery. The capital is $50,000, and the incorporators are H. Sutcliffe, W. O'Connor and C. E. Fisk, Jersey City, N. J.

BUFFALO, N. Y.—The McKinnon Chain Company has been incorporated to manufacture chain steel, and to engage in electric welding, with a capital of $1,000,000. The incorporators are: L. E. McKinnon, W. A. Notman and R. L. Notman, Buffalo.

BUFFALO, N. Y.—The Bogart Gas Power Engineering Company has been incorporated to manufacture gas engines, gasoline engines, motors, electrical goods, etc., with a capital of $25,000. The incorporators are: S. Ginsburg, J. A. Venable, Buffalo, and B. Ginsburg, Detroit, Mich.

ATLANTIC, IOWA—The Electric Automatic Carrier Company has been incorporated under the laws of South Dakota with a capital of $1,000,000 to exploit a trolley-wire system for rural mail delivery, invented by E. W. Riggs, who is president. J. S. Harkan is secretary, and Charles R. Hunt, treasurer. C.

PERSONAL MENTION.

THEODORE W. RICHARDS, professor of chemistry at Harvard, has been made a doctor of science by the Victoria University of Manchester, Eng.

FRANCIS A. STRATTON has been elected president of the Westchester (N. Y.) Lighting Company. He is also president of the Northern Westchester Lighting Company and the Peekskill Lighting and Railroad Company.

J. BRODIE SMITH, general manager of the Manchester Traction, Light and Power Company, Manchester, N. H., was married to Miss Charlotte D. Stewartson, at his summer home, on Uncanoonuc Mountain, July 14. Both bride and groom are prominent in Manchester business and society circles.

JOHN DALE, president of the Dale Company, New York, N. Y., and Mrs. Dale are spending the summer months in the Alps of Switzerland. Mr. Dale, who was quite ill for several weeks in the early part of the summer, is now greatly improved in health, and expects to return in about six weeks completely recovered.

HUGH M. WILSON, well known in trade journalism by his connection with the *Railway Age*, later consolidated with the *Electric Railway Review* and *Street Railway Journal*, as publisher

and proprietor, has entered a new field, becoming, on July 3 last, a director and vice-president of the Barney & Smith Car Company, of Dayton, Ohio. Mr. Wilson will enter on his new duties on August 1 next.

M. L. NEWMAN & COMPANY announce the opening of an office for consulting and industrial engineering at 25 Broad Street, New York. M. L. Newman, the senior member, is perhaps best known by his long experience for the Government at the Brooklyn Navy Yard. Alfonse Kaufman recently severed his connection as manager of the Alaska Chemical Company, to become actively engaged with Mr. Newman in consulting and industrial engineering in the above company.

LOUIS WINDMULLER, in the May *Forum*, has presented a logical and stirring analysis of present-day conditions in commerce in an article entitled "Under the Spell of Protectionism." Mr. Windmüller points out the discrepancies in the selling values which obtain here and abroad for products which are manufactured in this country, and indicates the unwisdom of such a policy, attributing to the high protectionist the attitude and the artifice of robbing Peter to profit Paul.

BYRON BRIGGS BRACKETT, A. M., Ph. D., professor of electrical engineering at the Clarkson Memorial School of Technology, Potsdam, N. Y., for the past six years, has been appointed head of the new department of electrical engineering at the South Dakota College, Brookings, S. D. Dr. Brackett is a graduate from the classical course of Syracuse University, and from post-graduate work in applied electricity, physics and mathematics at Johns Hopkins University. He holds both a certificate of proficiency in electrical engineering and a doctor's degree from the latter institution. He has taught electrical engineering in Union College and Rutger's College, as well as Clarkson. He is a member of the Phi Beta Kappa scholarship society, also the Sigma Xi scientific honor society. In addition to membership in several of the national engineering societies, he has been a president of the St. Lawrence County Science Club during the past two years. Dr. Brackett and his family are leaving Potsdam and will spend July and August at the Thousand Islands and central New York. He will take up his new work, as head of the electrical engineering department at the South Dakota College, Brookings in September next.

RAY D. LILLIBRIDGE announces the change of his office location to 100 Broadway and the taking into partnership of William L. Rickard. Mr. Lillibridge started business under his own name at 20 Broad Street, New York, about ten years ago, after having had a general advertising agency experience and later serving as advertising manager for some concerns in the technical line, notably the C. W. Hunt Company. The idea occurred to Mr. Lillibridge of rendering advertising service to several non-competitive concerns on a salary or retainer basis, eliminating entirely commissions from publishers, upon which is based the agency business. Mr. Lillibridge also engaged in preparing and circulating catalogues and other media in a comprehensive way not contemplated by the ordinary agency. This business was successful from the beginning. Coincident with its establishment Mr. Lillibridge secured the accounts of the American Bridge Company, the Electric Storage Battery Company, the Link Belt Engineering Company, and subsequently the Stanley Electric Manufacturing Company, the Otis Elevator Company, Dodge & Day, and the White Sewing Machine Company's automobile department. In 1901 the business was moved to 170 Broadway, where it remained until the first of May of this year, followed by a temporary shift, and then the establishment of the present address. Mr. Rickard was for eighteen years with the Otis Elevator Company, entering the employ of that company as a boy. For a number of years he occupied the position of assistant to Vice-President Mills, in charge of the sales, and later was manager of the Otis Elevator Company's foreign department. His experience and work with the Otis Company eminently qualified him for a business such as technical advertising, and his connection with Mr. Lillibridge has been a peculiarly satisfactory arrangement.

OBITUARY.

LEFFERT L. BUCK, former chief engineer of the Bridge Department of New York City, died suddenly on July 17 at his home in Hastings-on-the-Hudson. He was apparently in the best of health and was preparing to go to his office when he was stricken with apoplexy. He died without regaining consciousness. Mr. Buck's name was connected with several of the greatest bridges in this country, among them the Brooklyn, Manhattan and Williamsburg bridges in New York City, two steel arch bridges at Niagara Falls, the Driving Park Avenue steel arch bridge and the Platt Street bridge over the Genesee River at Rochester, the Columbia River bridge for the Northern Pacific Railroad at Pasco, Wash., and the Verugas bridge in Peru. He retired as chief engineer of the department in New York city in 1902, after a controversy with Bridge Commissioner Gustav Lindenthal over the policy of the department. Mr. Buck was born in Canton, N. Y., in 1837.

ELECTRICAL SECURITIES.

The market is under the influence of the usual July dullness. The public is not in it, and as far as prices are concerned it looks just now as though the bull trend had reached its limit. On the other hand, there are no signs of liquidation on the part of important interests, and therefore it is probable that late in August there will be another upward movement, as all conditions are favorable and the situation is quite sound. The only uncertain points are the tariff and the rather poor reports about the cotton crop.

Electrical securities of all kinds are being floated at this time and are regarded with favor.

DIVIDENDS.

Albany Home Telephone Company; a regular quarterly dividend of one per cent, payable July 20.

American District Telegraph Company of New Jersey; the regular quarterly dividend of one per cent, payable July 22.

American Light and Traction Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable July 20; the usual quarterly dividend of two per cent, and an extra one per cent on the common stock, payable August 2: also from undivided profits a dividend of one share of common on every ten outstanding, payable on or before September 1 to common stockholders of record July 20.

Columbus Railway Company; the regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable August 2 to stock of record July 15.

Commonwealth Edison Company; the regular quarterly dividend of one-and-one-half per cent, payable August 2 to stock of record July 20.

Connecticut Railway and Lighting Company; the regular quarterly dividend of one per cent on the common and one per cent on the preferred stocks, payable August 15.

Edison Electric Illuminating Company of Boston; the regular quarterly dividend of two-and-one-half per cent and one per cent extra, payable August 2 to stock of record July 20. (An extra dividend of one per cent has been declared at this period in the past two fiscal years.)

Electric Bond and Share Company; its initial dividend of two per cent on its common stock, payable to stockholders of record July 14.

Havana Electric Railway Company; regular quarterly dividend of one per cent on the common stock, payable August 14 to stock of record July 24; also, regular quarterly dividend of $1.50 per share on the preferred stock of the company, payable August 14 to stockholders of record at the close of business July 24.

Michigan State Telephone Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable November 1; also, the regular quarterly dividend of one-and-one-half per cent on the common stock, payable September 1.

NEW YORK.	July 19.	July 12.
Allis-Chalmers common	15	15
Allis-Chalmers preferred	51¾	51⅝
Amalgamated Copper	82¼	81¼
American Tel. & Cable	80*	80*
American Tel. & Tel	140⅝	140½
Brooklyn Rapid Transit	78¾	78
General Electric	165	163½
Interborough-Metropolitan common	15⅝	11
Interborough-Metropolitan preferred	48½	30⅛
Kings County Electric	130	130
Mackay Companies (Postal Telegraph and Cables) common	79¼	..
Mackay Companies (Postal Telegraph and Cables) preferred	73⅝	..
Manhattan Elevated	145	145
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	124	125
U. S. Steel common	72⅛	68⅞
U. S. Steel preferred	127¼	125⅝
Western Union	72¼	71¾
Westinghouse common	84⅝	84
Westinghouse preferred	..	121

*Last price quoted.

BOSTON.	July 19.	July 12.
American Tel. & Tel	140⅝	140½
Edison Elec. Illuminating	250	248
General Electric	165	163½
Massachusetts Electric common	12½	13¼
Massachusetts Electric preferred	72⅛	71½
New England Telephone	133	134
Western Tel. & Tel. common	10½	10
Western Tel. & Tel. preferred	86	37

PHILADELPHIA.	July 19.	July 12.
American Railways	45½	44¾
Electric Company of America	12⅝	12⅝
Electric Storage Battery common	53	52
Electric Storage Battery preferred	53	52
Philadelphia Electric	11¾	11¾
Philadelphia Rapid Transit	28½	28¾
Philadelphia Traction	90¾	91
Union Traction	53	53

CHICAGO.	July 19.	July 12.
Chicago Railways, Series 1	112	112
Chicago Railways, Series 2	38¼	41
Chicago Subway	20½	21
Chicago Telephone	133	132
Commonwealth Edison	121	120½
Metropolitan Elevated common	16¾	15
Metropolitan Elevated preferred	48	47
National Carbon common	91¼	91
National Carbon preferred	118	115

INDUSTRIAL ITEMS.

WICKES BROTHERS, Saginaw, Mich., are distributing their monthly stock list, dated July 15.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is distributing an interesting folder describing the many points in favor of metal molding.

THE ELECTRIC GOODS MANUFACTURING COMPANY, Boston, Mass., is distributing a unique folder naming twenty points in favor of Hub annunciators.

THE KEYSTONE LUBRICATING COMPANY, Philadelphia, Pa., is distributing a folder describing the advantages of mineral grease over animal grease for lubricating purposes on electric railway motors.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, O., has issued a folder containing several illustrations of the uses of its lifting magnet, copies of which may be had on request.

GEORGE GARRETSON, San Diego, Cal., who handles the "K. & G." single and two-spindle boring machines for boring holes at any angle in ceiling rafters, etc., has issued some unique literature pertaining to his wares.

THE DIEHL MANUFACTURING COMPANY, Elizabethport, N. J., announces that owing to increased business, its New York office, of which C. C. Remsen is manager, has moved from the previous address at 561 Broadway to 90 Prince street.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing two new bulletins, one descriptive of Siemens Arc Light Carbons, and the other Perkins and Bryant socket material. Both of the bulletins contain a complete list of the latest prices.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., has removed the sales office formerly located at Tucson, Ariz., to 173 San Francisco street, El Paso, Texas, where it will be continued as a branch of the Los Angeles office.

THE CHARLES L. KIEWERT COMPANY, Milwaukee, Wis., American distributor of Siemen's carbons, is publishing a price-list and some descriptive matter concerning Siemen's "A" carbons for direct-current and alternating-current circuits for moving picture arc lamps. Full information will be furnished to those interested upon request.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., announces that J. C. Murray has been appointed district sales engineer of the states of Illinois, Indiana, Ohio, West Virginia, Kentucky and the southern territory. F. C. King, of the Logansport Home Telephone Company, will continue Mr. Murray's excellent work in Indiana.

THE NATIONAL-ACME MANUFACTURING COMPANY, Cleveland, Ohio, has issued a general catalogue of Acme automatic multiple-spindle screw machines, and Acme semi-automatic screw slotting machines. The printing and illustrations in this handsome publication are unsurpassable, and frequent use is made of "phantom" pictures to show the interior working parts while preserving the main outlines of the machine illustrated.

THE CROCKER-WHEEELER COMPANY, Ampere, N. J., held a directors' meeting the early part of this month at the New York office of the company. The following officers were elected for the ensuing year: President, Dr. Schuyler Skaats Wheeler (re-elected); first vice-president, Gano Dunn; second vice-president, A. L. Doremus; chief engineer, Gano Dunn; secretary, Rodman Gilder; treasurer, W. L. Brownell; assistant treasurer, G. W. Bower.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has just published Bulletin No. 1519, describing type "An," Tomlinson Barometric Condensers. In addition to a complete and instructive description of the operation of these condensers, made clearer, if possible, by sketches, this bulletin gives information regarding pumps, air leaks at stuffing boxes, the remedy, and other sources of trouble which should prove of general interest to those interested in condensers.

THE GENERAL ELECTRIC COMPANY has issued Bulletin No. 4658, describing the Type US-14 Ball-Bearing Trolley Base. The type of double ball bearing used on this base produces an extremely sensitive action which, by eliminating the arcing, pounding, wrenching, etc., inherent in ordinary forms, insures a minimum wear on trolley wheel and overhead construction. A cushioned stop is provided to protect the pole from bending or breaking should the wheel leave the wire. A list of supply parts for this base is also contained in this publication.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H., has issued an instructive pamphlet describing the Hoyt Triune voltammeter for direct current. This voltammeter combines practically three instruments in one, a ten-volt coil for testing storage batteries and making other voltage measurements, a thirty-ampere coil for testing dry cells, and a one-and-one-half-ampere coil for testing coil units. Instructions for use are given, and a method of testing coils of an automobile ignition system with the engine stopped is diagrammatically illustrated.

THE MILWAUKEE LOCOMOTIVE MANUFACTURING COMPANY, Milwaukee, Wis., has brought out a very handsome trade booklet on gasoline-driven locomotives, publication No. 150. The company describes the locomotives as being made for service in manufacturing plants, mills, lumber yards and camps, mines, plantations, quarries, railroad, electric railway, tunnel and canal construction, general freight and passenger transportation. A general description of the locomotive, with handsome illustrations of the work done, is given, and a compact catalogue of the various types made occupies the latter part of the brochure. A form of questions put for the benefit of intending purchasers is also given.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY. Pittsburg, Pa., has issued a handsomely printed little booklet describing the applications of its line of small motors to office, store and shop services. The numerous illustrations scattered through the pages suggest many time and labor-saving uses for these efficient little power devices. Among these are the motor-driven adding machine, mailing machine, eraser, graphophone, envelope sealer, vacuum cleaner, buffing and polishing wheel, blower, sign-flasher, box-covering machine, hand drill, hack saw, coffee grinder, etc.—applications selected at random from the large number of uses where the electric motor provides the ideal power. The booklet, "Westinghouse Electric Motors for the Office, Store and Shop," will be sent on request.

THE INDUSTRIAL INSTRUMENT COMPANY, Foxboro, Mass., supply data on their instruments in the form of engineering bulletins, each bulletin being devoted to a certain line or class of meters, or to those instruments of different classes that group themselves conveniently for a certain industry. This method shares much of the elasticity of loose-leaf catalogues without involving the trouble of their maintenance. It furthermore eliminates the formidable general catalogue, only a small part of the contents of which is of interest to the average customers. The engineering bulletin treats one type or class of instruments exhaustively, without including irrelevant matter. The varioust bulletins published by this company are 8x11 in size and punched for binding together in substantial covers.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has issued a catalogue and price list of its Keystone insulated rail joint. This rail joint is so designed and constructed that the track may maintain its surface and alinement, that the joint be of neat appearance, compact and easily applied, that maintenance and renewals be readily accomplished and that current leakage be a minimum. The special feature of the joint is that there is a metal filler under the rail head, which increases the area of insulating material, and receives the shocks from passing trains. The filler and angle bar are of rolled steel. The angle bar section is such that it makes the joint as strong to resist both vertical and horizontal stresses as is the non-insulated joint. The only material used other than steel is insulating fiber, the area of which is such that the pressure per square inch upon it is low, as compared to the pressure between the ordinary angle bar and the rail.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued a number of new publications, as follows: Bulletin 4661 contains a description of aluminum arresters for alternating-current circuits, which up to a certain critical voltage allow an exceedingly low current flow, but which, at higher voltages, permit a flow of current which is limited only by the exceedingly low internal resistance of the arrester cell. These arresters have an enormous discharge capacity, and their design and construction enable them not only to discharge large quantities of lightning, but to safely take care of continuous and recurrent discharges lasting for long periods. Bulletin 4662 describes the various types of Thomson recording wattmeters, of various current capacities, for switchboard service. Dimensions and connection drawings of these meters are given. Bulletin 4663 covers lightning arresters for both alternating and direct-current circuits. These arresters, designed upon an elaboration by Prof. Elihu Thomson's fundamental patents, consist of a series of spark gaps shunted by graded resistances but without series resistance. The bulletin gives detailed information with regard to the construction and design of the various types of multi-gap arresters, together with curves, illustrations, dimensions and connections. These cover not only the arresters, but also the auxiliary apparatus, including disconnecting switches, choke coils, horn gaps, etc. Bulletin 4669 describes the various types of Curtis steam turbines for low pressure and mixed pressure, and contains also curves showing tests of an engine in combination with a low-pressure Curtis turbine, and a chart showing the power output and costs. These clearly indicate the increased capacity and economy secured by installing low-pressure turbine sets. All the above bulletins are splendidly illustrated, and the letterpress and general style are unexcelled.

DATES AHEAD.

Maine Electric Association. Annual convention, Portland, Me., July 29-30.

Society of Automobile Engineers. Annual convention, Chicago, August 5-7.

Michigan Electric Association. Annual convention, Detroit, Mich., August 17-19.

Old-Time Telegraphers' and Historical Association. Annual reunion, Pittsburg, Pa., August 17-19.

Indiana Electric Light Association. Next meeting, French Lick Springs, Ind., August 18 and 19.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 6, 1909.

It has been impossible to publish a list of electrical patents issued on Tuesday, July 13, owing to the failure of the delivery of the Official Gazette of the United States Patent Office up to the time of going to press.

926,732. ARC LAMP. Richard Fleming and Cromwell A. B. Halvorson, Jr., Lynn, Mass., assignors to General Electric Company. Filed November 16, 1903. Means are provided for simultaneously reciprocating one electrode and oscillating the other, non-consuming, electrode.

926,754. SOCKET FOR ELECTRIC LAMPS. William G. Lindemann, Milwaukee, Wis. Filed February 20, 1909. A casing has means at its lower ends for supporting the shade holder from its exterior surface and the switch mechanism from its interior surface.

926,792. ELECTRIC ARC LAMP. William S. Weedon, Schenectady, N. Y., assignor to General Electric Company. Filed March 12, 1904. Renewed April 7, 1906. One portion of an electrode is caused to be impinged against one portion of a pivoted block of carbon to turn the latter about its pivot and thereby force another portion of the block into contact with a different portion of the electrode.

926,793. ARC LAMP. William S. Weedon, Schenectady, N. Y., assignor to General Electric Company. Filed June 13, 1904. Renewed April 7, 1906. Means are provided for moving one electrode into line with a stop normally out of alinement with the electrodes, and another means for thereafter allowing it to drop into engagement with the same in a feeding operation of the lamp.

926,818. BLOCK SYSTEM FOR RAILWAYS. George W. Nistle, North Muskegon, Mich., and Edward Inskip and Bernard W. Brady, Chicago, Ill. Filed November 18, 1907. A contact lever operating circuit-controlling devices and pivoted between its ends upon a suitable support is provided with two oppositely inclined track surfaces whereby the lever is oscillated and its position changed twice by a traversing member carried by a train.

926,831. TELEPHONE JACK. Alfred L. Sohm, Whittier, Cal., assignor to National Electric Works, Whittier, Cal. Filed August 4, 1908. The several subscriber jacks may be independently removed.

926,857. TERMINAL FOR ELECTRIC CABLES. Charles W. Davis, Edgeworth, Pa., assignor to Standard Underground Cable Company, Pittsburg, Pa. Filed August 3, 1908. Comprises a thimble for securing to the sheath of a cable a conducting element for connecting the cable conductor to an aerial, a disk carried by the conducting element, and an insulating sleeve interposed between the thimble and disk and adjustably connected to the thimble.

926,874. MOTOR-CONTROLLING DEVICE. Leopold Janisch, Berlin, Germany, assignor to General Electric Company. Filed October 10, 1907. An electromagnetic switch to throw a resistance in the motor circuits in and out of circuit to vary the motor speed is closed by the initial movement of the motor-controlling mechanism and opened when the motor reaches a predetermined speed.

926,884. AUTOMATIC CARRIER. Sam H. Libby, East Orange, N. J., assignor to Sprague Electric Company. Filed August 7, 1905. An automatic electrically-driven carrier comprises a hoisting motor and a traversing motor, with a control switch for the former and a reversing switch for the latter, both switches being controlled by a height-limit device.

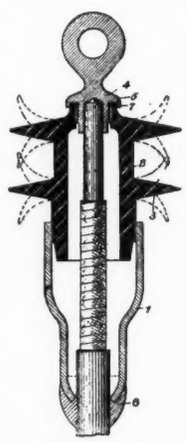
926,890. ELECTRIC LOCK. Thomas C. Nixon, Chicago, Ill. Filed February 19, 1908. The armature of an electromagnet is arranged to resist movement of the bolt except when the magnet is energized.

926,900. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J. Filed December 10, 1908. In combination with a source of energy are a number of pairs of differentially related inductances associated therewith, and a transmitter for controlling an inductance of a pair, whereby the combined inductance of that pair is greatly reduced and the consequent increased current greatly reduces the combined inductance of another pair.

926,906. DISTRIBUTING INSULATOR BRACKET. Albert L. Stadermann, Terre Haute, Ind. Filed June 26, 1907. The insulators are supported by a U-shaped member adapted for securing to a pole.

926,933. WIRELESS TELEGRAPHY. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed March 22, 1905. A spark-gap device for wireless-telegraph transmitting apparatus includes a vacuum tube having a condensing chamber at one end and containing a liquid electrode at its other end, and having also between its ends laterally offset depending pockets, each containing a liquid electrode with a circuit terminal extending into it.

926,934. WIRELESS-TELEGRAPH TUNING DEVICE. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed January 20, 1906. A spiral of metallic ribbon has a contact operating transversely across it whereby its capacity and inductance may be varied in a continuous manner.



926,857.—TERMINAL FOR ELECTRIC CABLES.

926,935. WIRELESS-TELEGRAPH TRANSMITTER. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed February 2, 1906. A double-walled ventilated muffler encloses the spark electrodes, which are electrically connected to a helix mounted on the muffler.

926,936. SPACE TELEGRAPHY. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed June 20, 1907. A system of space telegraphy comprises a circuit capable of developing a practically continuous train of high-frequency electrical oscillations, a radiating conductor associated therewith, an oscillation circuit capable of developing intermittent trains of electric oscillations of much lower frequency and associated with the other circuit, and a controllable source of vibratory electromotive force associated with the oscillation circuit.

926,937. SPACE TELEPHONY. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed June 25, 1907. Each of a number of oscillation circuits has a transmitting device. Means common to all of the transmitting devices are provided for controlling the same, also means for converting the energy of the oscillation circuits into electroradiant energy.

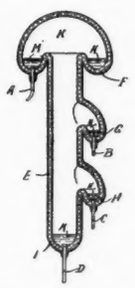
926,950. AUTOMATIC RINGING CIRCUIT AND APPARATUS FOR TELEPHONE EXCHANGES. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Filed February 1, 1907. A balanced thermal relay connected on one side to the generator wire controls the ringing relay.

926,951. ELECTRICAL SWITCH. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company. Filed February 28, 1907. Describes a form of hook-switch for effecting circuit changes in a telephone set.

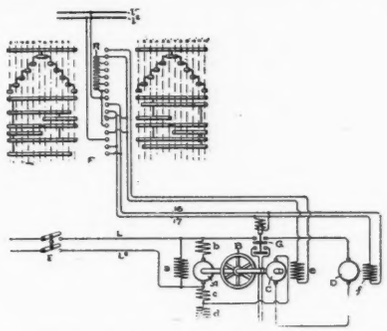
926,956. ILLUMINATING DEVICE. William N. McComb, New York, N. Y. Filed March 25, 1908. A multi-colored electric display device has a number of groups of compartments, those belonging to the same group showing a unitary design of the same color when lighted.

926,962. THERMAL CUT-OUT. Frank D. Reynolds and Joseph Sachs, Hartford, Conn., assignors to the Sachs Company, Hartford, Conn. Filed January 7, 1908. Renewed December 12, 1908. The fuse strip has angularly disposed, radially projecting and longitudinally extending flanges.

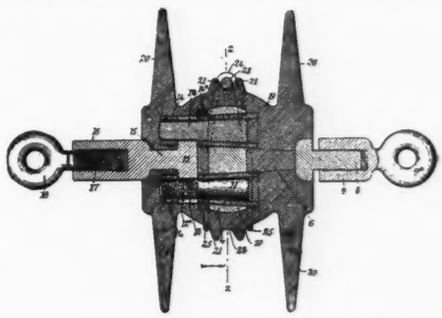
926,976. SPARK INDICATOR. Frank W. Brandow, Pittsfield, Mass., assignor to Jacobson-Brandow Company, Pittsfield, Mass. Filed August 5, 1907. An adjustable electrode mounted on an insulation base comprises an upwardly extending support on which is a sleeve or casing, and a movable stem member projected through the sleeve is provided at one end with a contact point and at the other end with means for manipulating the stem member.



926,933.—WIRELESS TELEGRAPHY.



927,178.—MOTOR-CONTROL SYSTEM.



927,186.—HIGH-POTENTIAL STRAIN INSULATOR.

926,994. TELEPHONE-CONNECTING APPARATUS. Edward C. Molina, Arlington, Mass., assignor to American Telephone and Telegraph Company. Filed June 19, 1907. A telephone-switching mechanism has transmission-line terminals, two groups of testing-line terminals with independent movable members contacting respectively with them, substation lines having third conductors connected to one group of test terminals, and groups of trunks with the third conductors connected to the other group of test terminals.

927,010. ELECTRIC ARC LAMP. Thomas Spencer, Philadelphia, Pa. Filed April 3, 1907. Bearings engaging the angularly disposed rods are provided with means for free oscillatory movement.

927,014. CONTROLLING DEVICE FOR VEHICLES. Richard Werkner, Budapest, Austria-Hungary. Filed January 14, 1908. Describes a method of control for a gasoline-electric vehicle.

927,018. ELECTRIC SIGN. Francis D. Ammen, New York, N. Y. Filed February 8, 1908. Describes a method of successively lighting and extinguishing the units of a series of lights to produce certain effects.

927,025. CALL-DISTRIBUTING TELEPHONE-EXCHANGE SYSTEM. Sidney H. Browne, Pittsburg, Pa., assignor to American Telephone and Telegraph Company. Filed February 11, 1905. Renewed October 25, 1907. A locking testing relay controls the energizing of a cut-off relay so that the former is de-energized by the de-energizing of a line relay.

927,027. ELECTRIC WATER HEATER. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr., San Francisco, Cal. Filed June 25, 1908. The heating chamber has a discharge opening and a feed tube extending into the chamber with means of deflecting the rising current from the descending current and thus providing for proper circulation.

927,045. COMBINED INSULATOR AND LIGHTNING ARRESTER. William F. Hiatt, Danville, Ind., assignor of one-half to Melville E. McHaffie, Greencastle, Ind. Filed August 24, 1908. The outer cylinder has a core of insulating material constructed of two separable sections, one of which has an irregular groove therein and the other a projection on it adapted to enter the groove and hold the wire therein.

927,111. ELECTRIC PROTECTION SYSTEM. Charles U. Carpenter, New York, N. Y. Filed November 23, 1908. Describes an electric protective system for a number of structures distantly removed from one another.

927,129. SIGNAL DEVICE. Frank S. Dombrowski, Chicago, Ill. Filed June 16, 1908. The upward movement of a float beyond a predetermined distance closes a circuit including an electric alarm.

927,142. ROTARY CONVERTER FOR DIRECT CURRENTS. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed March 28, 1908. Sets of field coils in the different field circuits are displaced circumferentially from each other, whereby a relative variation of current in the circuits shifts the field magnetization circumferentially with respect to the field magnets and the brushes so as to vary the relative amounts of voltages induced in the armature between the two sets of brushes.

927,173. ELECTRIC HEATER. Karl Schlüter, Kiel-Gaarden, Germany, assignor to Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden, Germany. Filed May 20, 1908. Tubular resistance members of nickel open at both ends are suspended from a top plate with the open ends of the tubes adjacent to the intake and outlet respectively.

927,178. MOTOR-CONTROL SYSTEM. John A. Seede, Schenectady, N. Y., assignor to General Electric Company. Filed May 28, 1908. Comprises a source of direct current supplying the motor of a flywheel motor-generator set, an auxiliary field winding on the motor connected across the terminals of the generator, a second motor supplied by the source and generator in series, and means for varying the potential of the generator so as to oppose the potential of the source when the second motor is starting and to assist the potential of the source when the second motor is running at high speed.

927,185. TUBULAR INSULATOR. Louis Steinberger, New York, N. Y. Filed June 4, 1906. A tube of insulating material comprises a number of cylindrical members disposed concentrically and connected together by spacing partitions.

927,186. HIGH-POTENTIAL STRAIN INSULATOR. Louis Steinberger, New York, N. Y. Filed July 30, 1906. Comprises a disk provided with holes of tapering diameter, sleeves of insulating material fitted into the holes, bolts of tapering diameter fitted into the sleeves and extending through the disk, mechanism connected with the bolts for exerting upon them a mechanical strain, and means for connecting the disk to a tension member.

927,187. INSULATOR. Louis Steinberger, New York, N. Y. Filed September 16, 1907. Comprises a number of disks of insulating material provided with holes, headed tension members provided with prongs for extending through the holes, and fastening members for engaging the prongs.

927,191. ELECTRIC MEASURING INSTRUMENT. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company. Filed November 13, 1907. Has means for producing a magnetic field of uniform density, and a triangular current-carrying coil mounted for bodily edgewise movement in the field along the line from the apex to the base of the triangle.

927,209. ARMATURE FOR ELECTRIC MACHINES. Walter J. Bauroth, Columbus, Ohio, assignor, by mesne assignments, to the Jeffrey Manufacturing Company. Filed August 23, 1906. Describes a form of laminated armature.

927,218 and 927,219. JUNCTION BOX FOR ELECTRICAL CONDUCTORS. James F. Burns, Philadelphia, Pa. Filed September 30, 1908. A spring clip retains the insulating bushing.

927,230. DICTOGRAPH. William F. H. Germer, New York, N. Y., assignor to General Acoustic Company. Filed July 31, 1908. A key normally opens one wire in each three-wire

circuit extending from a stenographer's station to each of the managers' stations, and is adapted to open another wire of each three-wire circuits to non-communicating managers' stations when talking circuits are established to any particular manager's station.

927,255. SPARKING PLUG FOR HYDROCARBON MOTORS. Abbot A. Low, Horseshoe, N. Y. Filed February 20, 1909. The threaded lower portion of the spark plug screws into a bushing which is secured in the wall of the combustion chamber.

927,274. DYNAMO-ELECTRIC MACHINE. Laurence A. Pape, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed August 19, 1907. Means are provided for automatically tightening the conductors on the rotor during the operation of the machine.

927,314. CURRENT INDICATOR OR DETECTOR. Clifford D. Babcock, New York, N. Y. Filed August 15, 1908. A Hertzian wave detector depends for its action on the property of a chemical salt which changes its conductivity as its temperature arises until a critical temperature is reached, and then increases its conductivity at a different rate for further changes of temperature.

927,318. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed May 17, 1906. The laminated core has circumferential ventilating passageways and the rotary field member comprises a rim (with field poles secured to it) having fan blades on one side, and a shield directs the air from the fan blades outward along one side of the core and across the outer periphery of the latter in one direction to the other side of the coil.

927,321. INSULATOR. John T. Bond, Palatka, Fla. Filed March 13, 1908. Has a number of longitudinal, spaced grooves intersecting an annular groove.

927,344. ADJUSTABLE CASING FOR LAMP SOCKETS. Edgar H. Freeman, Trenton, N. J. Filed July 15, 1908. Has a number of positioning slots opening through one end, and a single locking hole.

927,346. SPARKING MECHANISM FOR EXPLOSIVE ENGINES. Gustavo Germani, Pittsburg, Pa., assignor of one-half to Raffaele Zangrilli, Pittsburg, Pa. Filed September 8, 1908. Means for starting an explosive motor consist of a generator, means embodying cam-grip mechanism for positively coupling the generator with the motor and for automatically uncoupling therefrom, independent actuating mechanism, and separate means embodying cam-grip mechanism for positively coupling the generator with the independent actuating mechanism, and for automatically uncoupling therefrom.

927,347. TELEGRAPHIC INSTRUMENT. John J. Ghegan, Newark, N. J., assignor to J. H. Bunnell & Company, New York, N. Y. Filed August 25, 1908. Comprises a baseboard with three binding posts, a transmitting key, a switch lever and a key frame having three insulated points to which the three binding posts are respectively connected, one being the contact for the key, another being the switch lever and the third a contact piece for the switch lever.

927,373. SPRING HINGE FOR ELECTRICAL AND OTHER DEVICES. Lembert H. Moulthrop, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed July 31, 1908. The faceplate of an electrical plug receptacle is provided with an opening with a door for closing the opening and provided with a hinge consisting on one side of a plain pin and on the other side of a spiral spring, secured at one end to the door and at the other to the plate.

927,375. ELECTRIC ISOLATION SYSTEM. Nathaniel C. McClure, Healdsburg, Cal. Filed October 18, 1907. The electromagnet of each subscriber's instrument is placed in the radial line of a deflectable arm carrying an oscillating coil, but in a different angular relation to every other subscriber and in a homologous relation to the indicator markings at the central office corresponding to that of the said subscriber.

927,377. SIGNALING SYSTEM. James G. Nolen, Chicago, Ill., assignor to John E. Shepherd, Chicago, Ill. Filed October 4, 1905. Engagement of an actuating spring with code teeth (provided at each station) causes a break in the line at each side of the spring.

927,384. CONNECTION BLOCK FOR ELECTRIC SERVICE CIRCUITS. Joseph G. Swallow and Walter E. McCoy, New York, N. Y., assignors of one-third to Frank W. Smith, New York, N. Y. Filed October 12, 1907. Binding posts are provided for service and circuit wires and also for wires to a meter or other electric appliance, and a series of intermediate receptacles for attachment of fuse plugs are provided for certain connections.

927,395. TELEPHONE TRANSMITTER. Charles Adams-Randall, New York, N. Y. Filed April 16, 1907. The diaphragm or other vibrating medium carries or supports a confined variable resistance of uniform depth, a low-resistance and large-conducting capacity is held in a confined mass under pressure in direct contact therewith, a co-operating electrode is in adjustable electrical contact with the variable resistance, and a source of current supply has connections with the variable resistance conductor and the co-operating electrode.

927,397. SINGLE-PHASE MOTOR CONTROL. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed January 4, 1908. The motor is started with the armature short-circuited, a voltage is then impressed on the exciting winding and a resistance in series, after which the armature short-circuit is opened so as to include the armature in circuit with the exciting winding, whereupon the resistance is cut out.

927,398. ALTERNATING-CURRENT MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed April 7, 1908. Has inducing and exciting windings on the stator, and an armature provided with a commutator, and brushes and connections short-circuiting the armature on the line of magnetization of the inducing winding through the central portion of the inducing winding.

927,399. ALTERNATING-CURRENT MOTOR CONTROL. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed June 1, 1908. Manually operated controlling means are arranged to short-circuit the motor armature at starting and to open the short-circuit for operation at high speeds, and an automatic controlling switch has an actuating winding connected in shunt to a field winding of the motor.

927,404. BLOCK-SIGNAL SYSTEM. Albert G. Davis, Schenectady, N. Y., assignor to General Electric Company. Filed March 28, 1906. Describes the details of an electric block-signal system.

927,413. INDUCTION COIL. Albert K. Keller, Lafayette, Ind., assignor to Sterling Electric Company, Lafayette, Ind. Original application filed September 9, 1907. Divided and this application filed August 3, 1908. An induction coil for telephone-desk sets comprises a core and windings thereon, a terminal head projecting above the coil and the windings, and instrument terminal secured to the head and forming one element of a spring-jack switch.

927,414. TELEPHONE SYSTEM. John M. Latimer, Flushing, N. Y., assignor to Consolidated Fire Alarm Company, New York, N. Y. Original application filed April 21, 1900. Divided and this application filed September 14, 1908. Repeating coils are connected to both leads of the telephone subscribers' circuit at the telephone exchange, so that they will be responsive to currents which flow through the telephone subscribers' leads in parallel and not to the telephone subscribers' signaling and talking current.

927,426. MOTOR-CONTROL SYSTEM. Wilhelm Naumann, Berlin, Germany, assignor to General Electric Company. Filed March 3, 1908. Means are provided for closing and opening a control circuit to a line switch for a motor rotating a hopper.

927,428. THIRD-RAIL-CONDUIT SYSTEM. Philip M. Reynolds, San Francisco, Cal. Filed November 30, 1908. A conduit for electric railways comprises a housing for the electric conductor or conductors, having a number of sections, and a conductor extending longitudinally of the housing and embedded therein and providing a continuous electrical connection.

927,433. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J. Filed July 22, 1908. A transmitter of electroradiant energy comprises oscillation-producing means connected with a source of energy, a number of pairs of differentially related inductances associated with the energy source, and a key for cutting in and out an inductance of each pair.

927,455. ELECTRICAL SELECTOR. Ernest A. Faller, New York, N. Y., assignor to the North Electric Company, Cleveland, Ohio. Filed April 8, 1904. A progressive contact maker comprises contact points divided into groups or sets, a normally rotating trailer arm adapted to make contact with multiple contact points of one group at one time, means for interrupting the rotation of the trailer arm, and means for controlling the interrupting means.

927,465. CONTROL APPARATUS. George H. Hill, Schenectady, N. Y., assignor to General Electric Company. Continuation of application filed August 13, 1906. This application filed April 18, 1908. A movable contact member is biased to the "off" position and is controlled by electromagnets.